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Vol. 28 Toronto, October 7, 1914 No. 40

Contract Record and Engineering Review

ESTABLISHED 1886

BELLISS & MORCOM, LTD.

Engines and Air Compressors

Over 150 Sets Installed in Canada

Laurie & Lamb
Sole Agents for Canada for

R. HORNSBY & SONS
Gas and Oil Engines

PATERSON ENGINEERING CO.
Municipal Filtration Plants

J. P. HALL & SONS
Boiler Feed Pumps

AVELING & PORTER
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Sewage Installations

LEYLAND ENGINEERING CO.
Motor Trucks and Fire Appliances

W. SMITH & SONS
Road Sweepers

S. H. JOHNSON & CO.
Filter Presses
"FRAM" Electric Wagons

HEENAN & FROUDE
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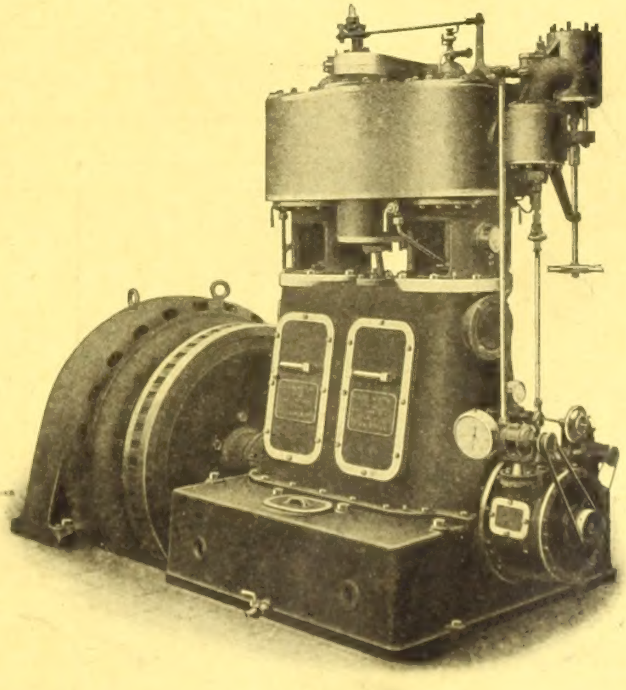

570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

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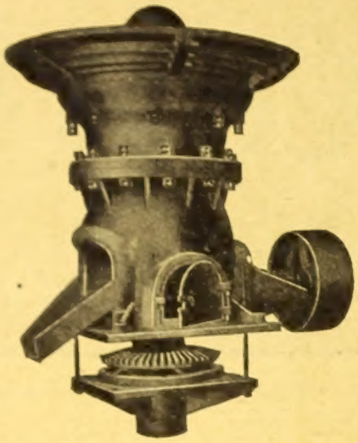


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

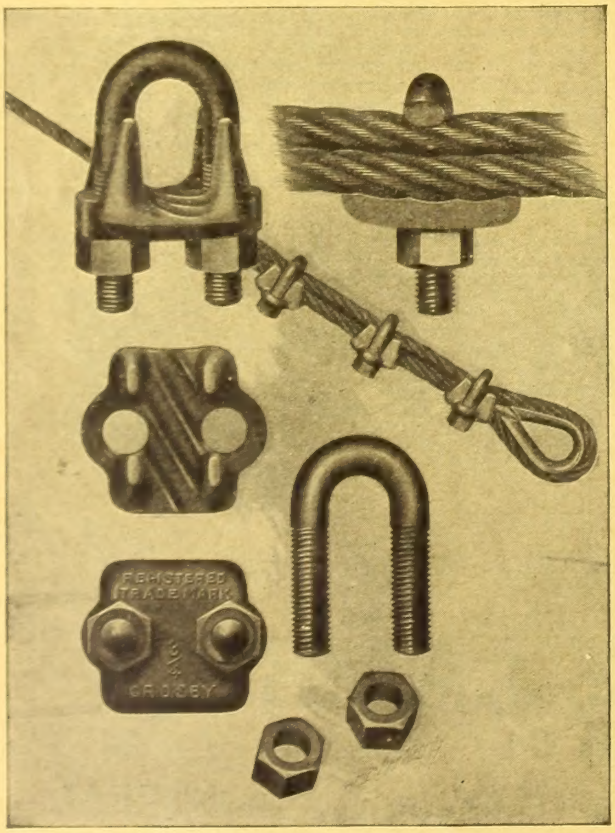
This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson



"CROSBY" CLIPS ALL WAYS, ALWAYS

The one absolutely secure and dependable wire rope fastening is the drop forged steel, galvanized

"CROSBY" CLIP

Built for greatest gripping power—immune to rust.

IT HOLDS

In the interests of safety use no other on guy or hoisting lines.

MADE BY

American Hoist & Derrick Co.
ST. PAUL, MINN.

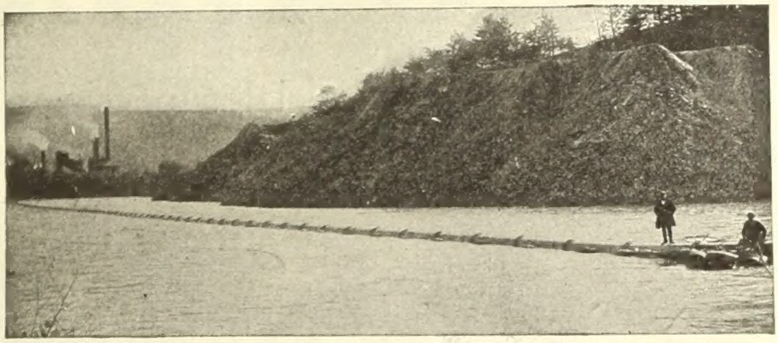
SOLD BY—General Supply Co., of Canada, Ltd. Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

For Permanent Lines :

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.



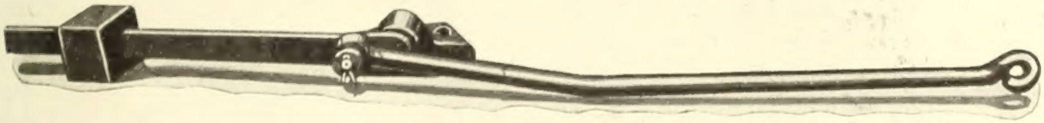
30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

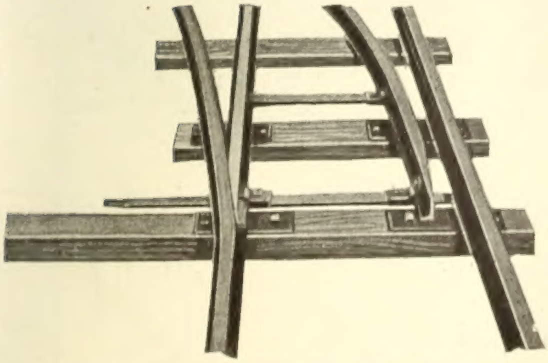
General Offices:—BURLINGTON, NEW JERSEY

Sales Offices:—Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh, St. Louis, San Francisco

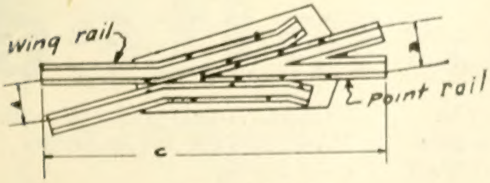
A Practical Switch



Standard Ground Throw



Switch Points, Connecting Rods and Slide Plates



Rivetted Plate Frog

The Bechtel Policy

Simplicity and Strength

has been closely adhered to in the manufacture of the Switch illustrated. This switch is constructed for spiking to wooden ties, and consists of one throw, one frog, one pair points (spliced rails 4 ft. long) and two connecting rods with clips and four slide plates. If desired, the throws can be put out of use temporarily by turning up several inches of the extending parts of the first connecting rod, so that the points can be moved with the foot.

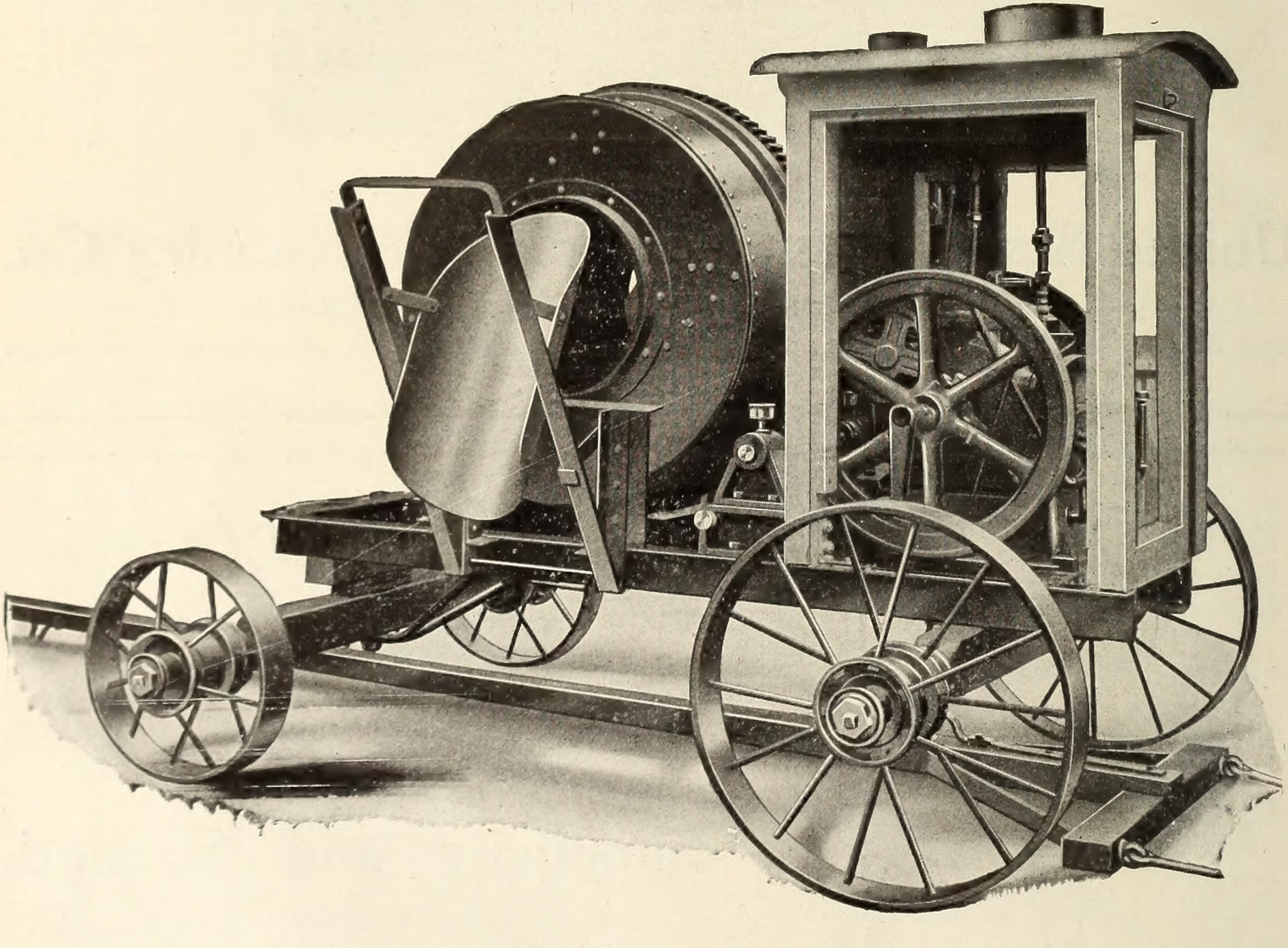
Full data and prices on request

Bechtels Limited

Waterloo, Ontario

MADE IN CANADA
Chicago Mixers

Are made in Montreal, under special supervision, and carry our full guarantee against defective material and workmanship.



The Mixer with only one Drum Ring, with centrally located Running Gear, Heavy Z-Bar Base, etc.

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Mussens Limited

MONTREAL, 318 St. James Street **TORONTO, 155 West Richmond St.** **COBALT, Opp. Right of Way Mine**
WINNIPEG, 259-261 Stanley Street **CALGARY, 10th Ave and 3rd St. East** **VANCOUVER, 101 Water St.**
QUEBEC, 142 Peter St. **HALIFAX, 78 Granville St.**

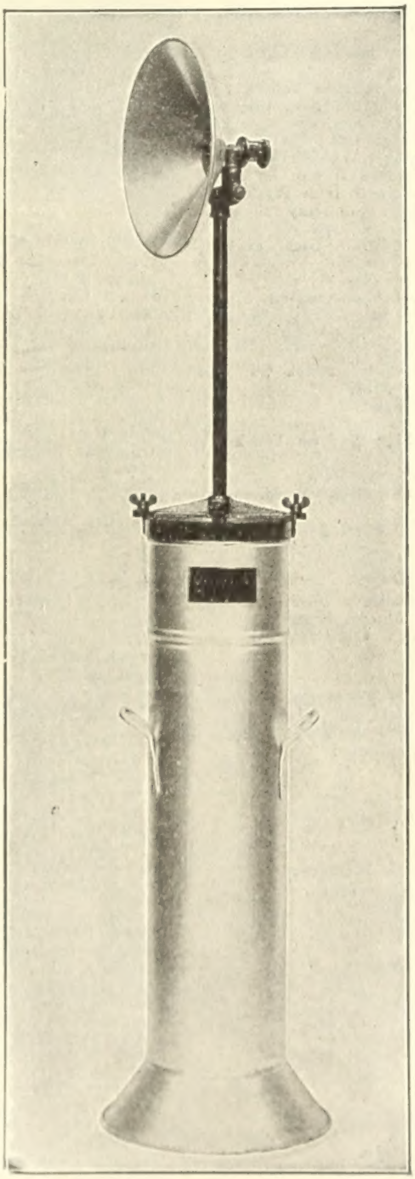
CANADIAN PRODUCTS

Patriotic Canadians will buy "Made in Canada" Goods

Carbic Lights

Are "Canadian" Lights yielding 2,000 C. P. at a cost of about five cents per hour.

The CARBIC LIGHT is the Cheapest, Simplest, Most Efficient light on the the market.



The CARBIC LIGHT is absolutely non-explosive, no waste when not in use.

Invaluable for night work, tunnel and trench work.

Easy to handle.

QUICK SHIPMENT

Mussens Limited

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Hull Iron & Steel Foundries

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Concrete Machinery
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Badger Concrete Mixer Co.
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Lecky & Collis

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Canadian Ingersoll-Rand Co.

(Continued on page 12)

Look at the Material the Austin Handles

Austin Trench Excavator digging for the City of Calgary, Alberta, Canada

You know about how the cost for hand labor in this kind of material would mount up. Most of those are "1-man" boulders the AUSTIN TRENCHING MACHINE is throwing out of the trench along with other material. The machine is built to stand the wear.

You are not always sure of easy earth excavation on your sewer or other trenching jobs. Why not buy a machine that stands up under heavy work?

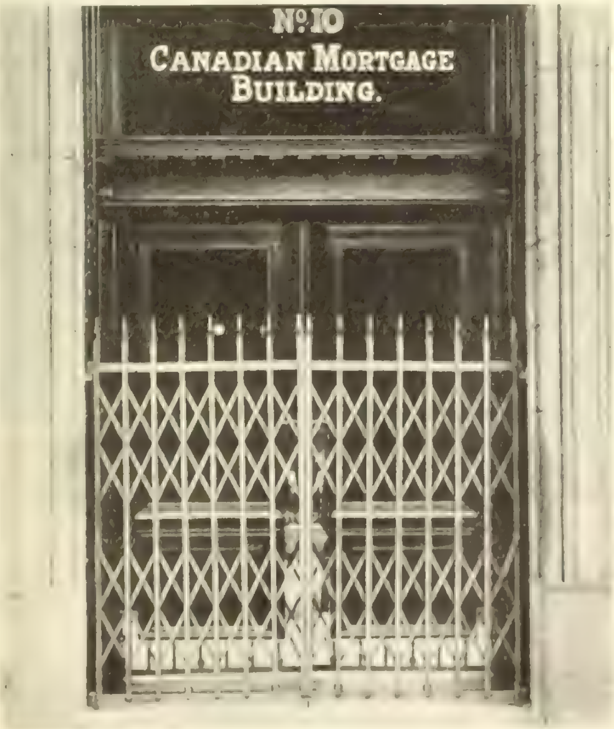
Contractors who have used Austin Trenching Machines for years will tell you the kind of service they give. You can dig a wide or narrow trench with the AUSTIN. You are not limited to a single width for each machine. Austin Trenching Machine No. 10, a popular type, will dig a trench from 24 inches to 6 feet wide, and any depth up to 25 feet.

Replace that big gang of laborers with two men and an Austin Trenching Machine. See the difference it will make in the speed of your work—and in your expense.

Write to our Canadian Representatives—the one nearest you.
Lecky & Collis, Limited, 49 Beaver Hall Hill, Montreal; 43 Scott St., Toronto, and P. O. Box 611, Napanee, Ontario.
Canadian Equipment & Supply Co., Calgary and Edmonton. E. G. Cullen, 418 Pacific Bldg., Vancouver
Dominion Equipment & Supply Co., Winnipeg, Manitoba

F. C. AUSTIN DRAINAGE EXCAVATOR CO.

Railway Exchange, CHICAGO, U. S. A.
Agents Wanted in Open Territory



Steel Collapsible Gates

We make a specialty of all types of Collapsible Gates for Main Entrances, Store Fronts, Elevator Openings, etc.

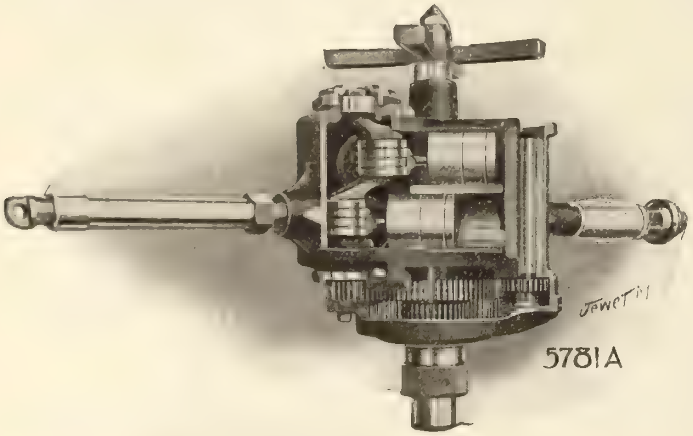
ILLUSTRATIONS AND PRICES GLADLY GIVEN

Aikenhead Architectural Metal Works

364-370 Richmond Street W., Toronto, Ont.

For Drilling, Tapping and Reaming Metals; For Driving Studs, Flue Rolling and for Wood Boring

USE "LITTLE DAVID" PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

You'll find "LITTLE DAVID" Drills the most satisfactory tools you have ever used.

CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver.

The Fire Department of New York City Uses Ceresit on an Important Job.

CERESIT
TRADE MARK

The water gate walls of the High Pressure Pumping Station, New York City, (shown above) were waterproofed with Ceresit.

Ceresit is as dependable a waterproofer for cement under conditions of extreme hydrostatic pressure as it is under conditions of moisture or light ground water pressure.

Write for our 1914 "Book of Evidence."

Ceresit Waterproofing Company
913 Westminster Bldg., CHICAGO
FACTORIES—Chicago, Unna, Germany: London, Paris, Vienna, Warsaw

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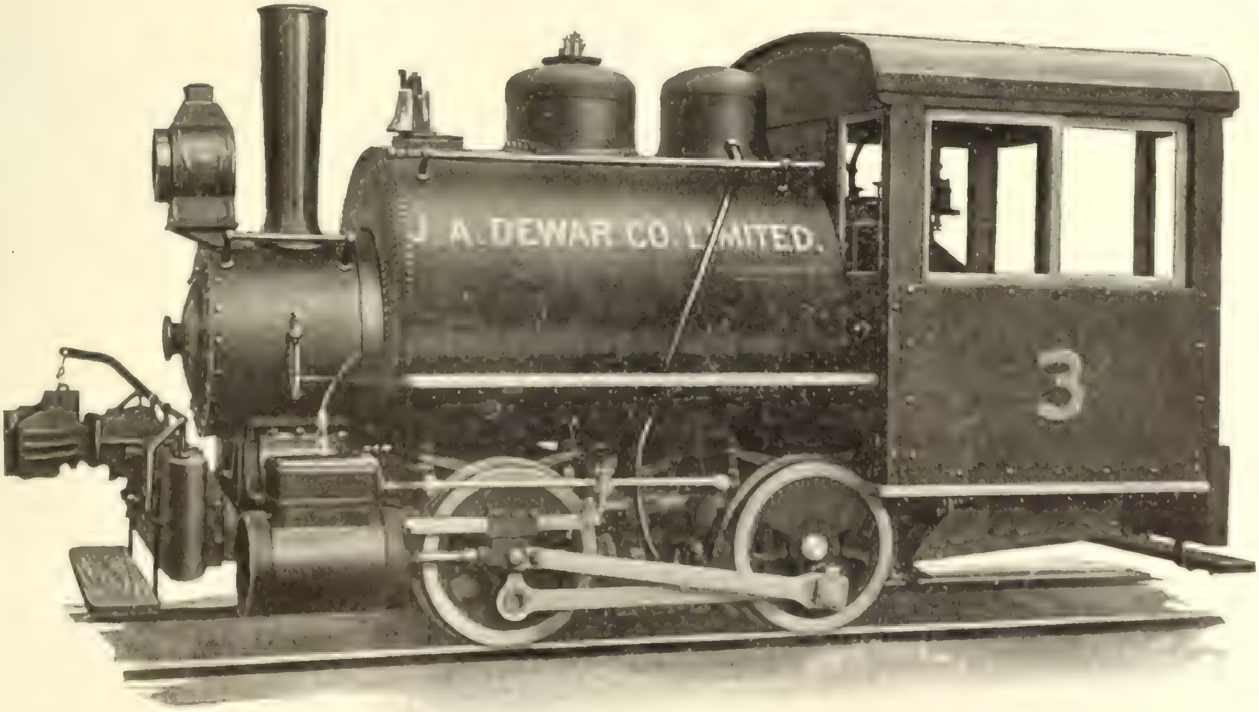
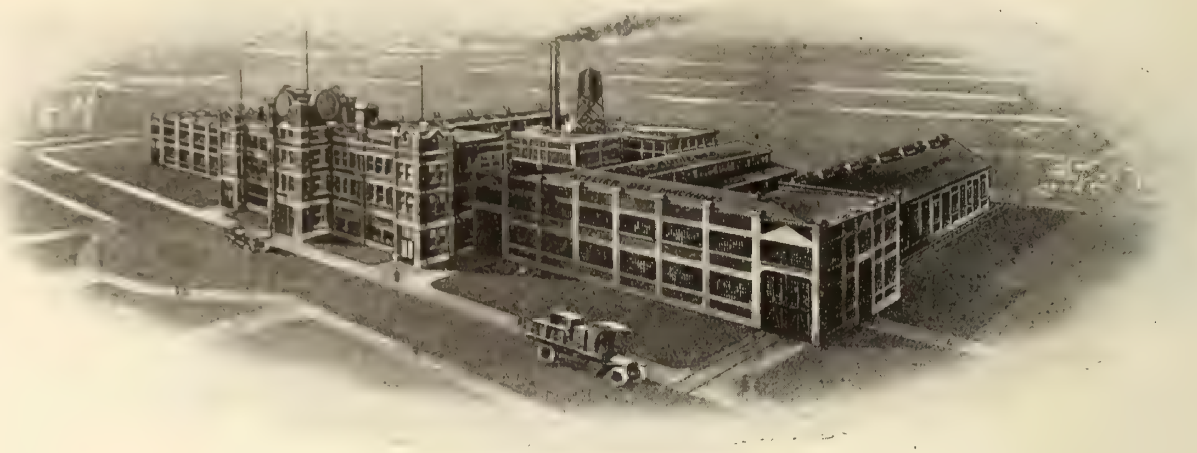


High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builder. Duplicate parts carried in stock for immediate shipment. Engines built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA
TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG



Head Office and Works

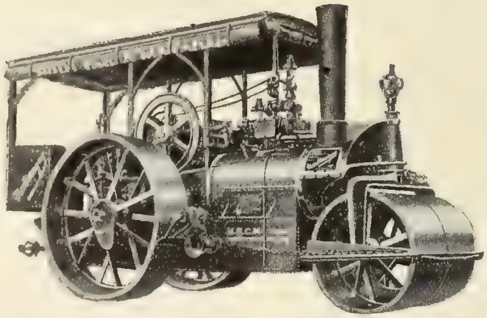
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "Montmagny" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



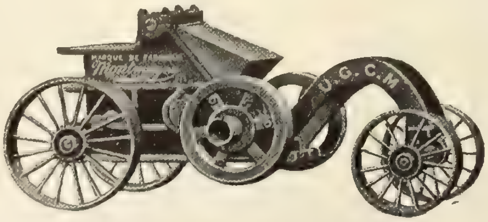
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

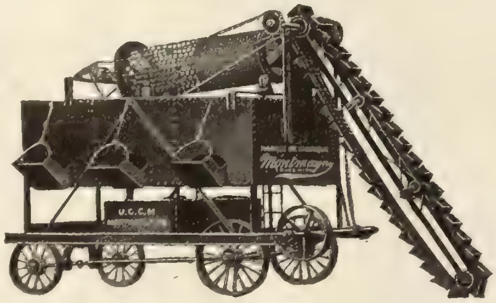
A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

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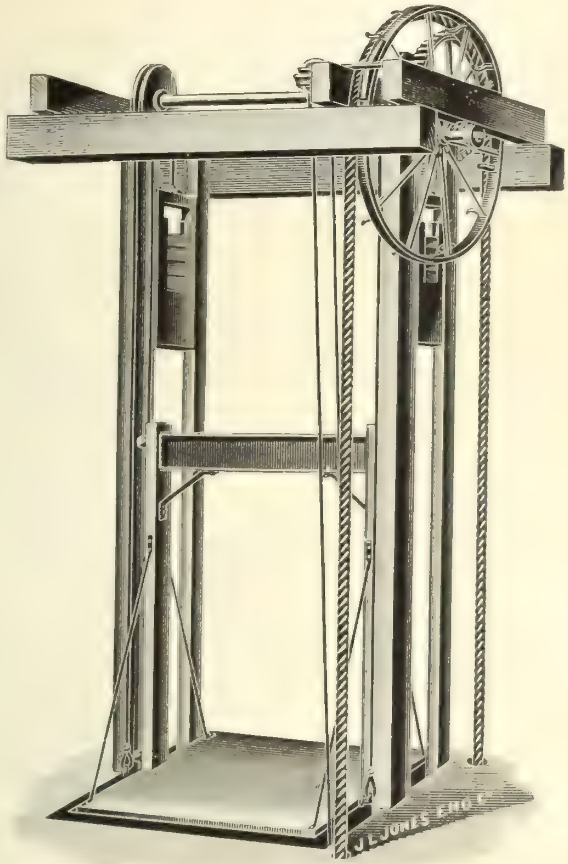
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Passenger
Freight
Hand Power
Dumb Waiters

The Turnbull Elevator Mfg. Co.
Toronto, Ont.

Canadian Factory of

TUEC STATIONARY VACUUM CLEANERS

Over 7,000 Satisfied Users who will testify as to its

EFFICIENCY,
SIMPLICITY,
AND
ECONOMY.

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TUEC COMPANY OF WINNIPEG
505 Boyd Block, Winnipeg

JAMES J. MARTINDALE
159-161 Richmond St. W. Toronto, Ont.

Recognized as the Standard for thorough cleaning of

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RESIDENCES,
SCHOOLS,
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LIBRARIES,
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CLUBS, ETC.

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105 Sixth Ave. West, Calgary

TUEC COMPANY OF MONTREAL
406 New Birks Bldg., Montreal

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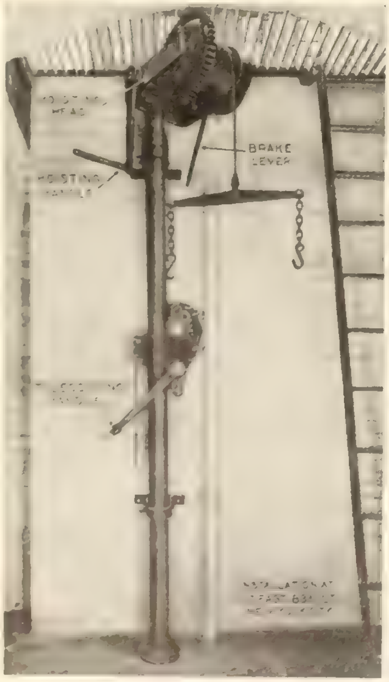
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

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1.—It is telescopic—no part showing above sidewalk when not in use.

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3.—Simple in construction and absolutely rigid when erected.

4.—It is made of strongest and most durable material.

5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.

6.—A powerful ratchet device is provided with both handles above mentioned.

7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

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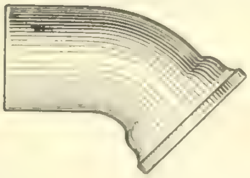

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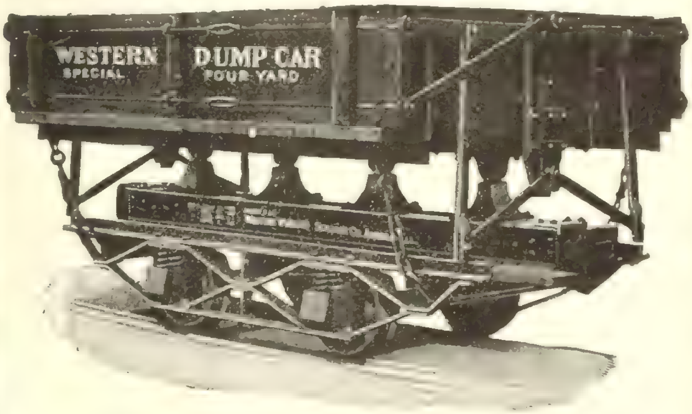

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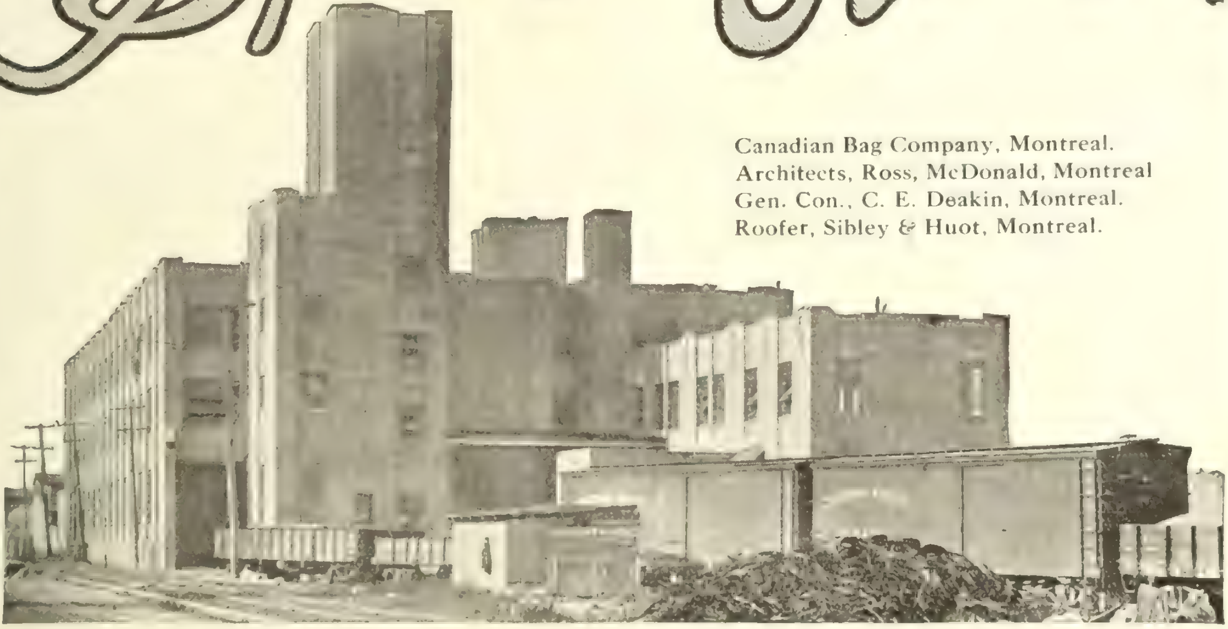

Canadian Bag Company, Montreal.
Architects, Ross, McDonald, Montreal
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A Barrett Specification Roof was put on this building because—

THE architect knew all about the different types of roofing and further knew that the Canadian Bag Company were mighty particular people.

They had a big plant and they wanted it covered with a roofing that would give ***long service at a low cost.***

Under such conditions the architect knew there was only one choice, namely: a Barrett Specification Roof, because it gives longer service at a lower **unit cost** (the cost per square foot per year of service) than any other roofing he could specify.

This building is now covered with a Barrett Specification Roof and it will probably last twenty years or more with **no maintenance cost.** Many such roofs have lasted thirty years.

Every permanent building, whether large or small, should carry a Barrett Specification Roof because that means the most economical roof, and one that will be free from leaks and maintenance.

Ask any first-class architect regarding this proposition and he will verify all of the foregoing statements.

Copy of A Barrett Specification with roofing diagrams mailed free on request.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

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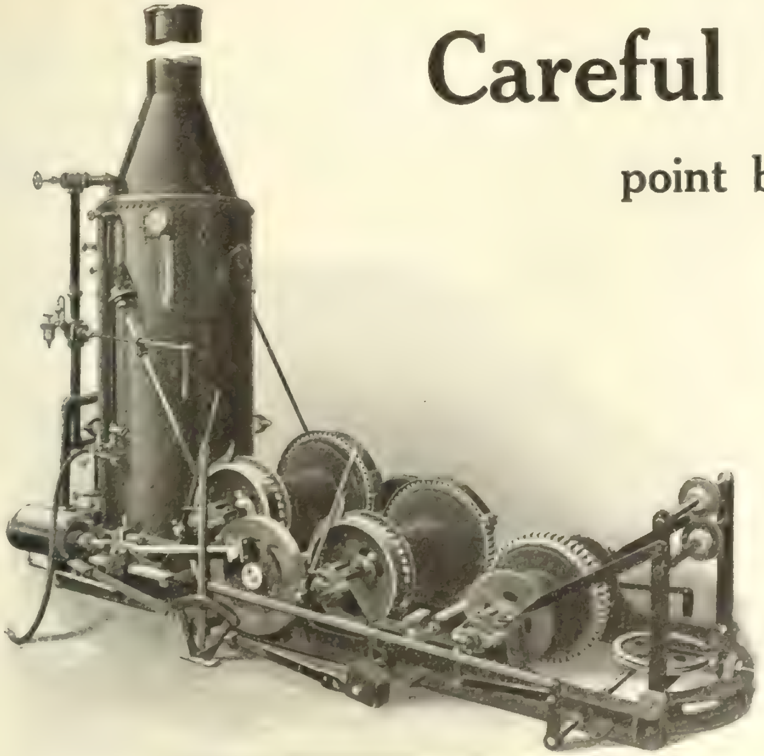

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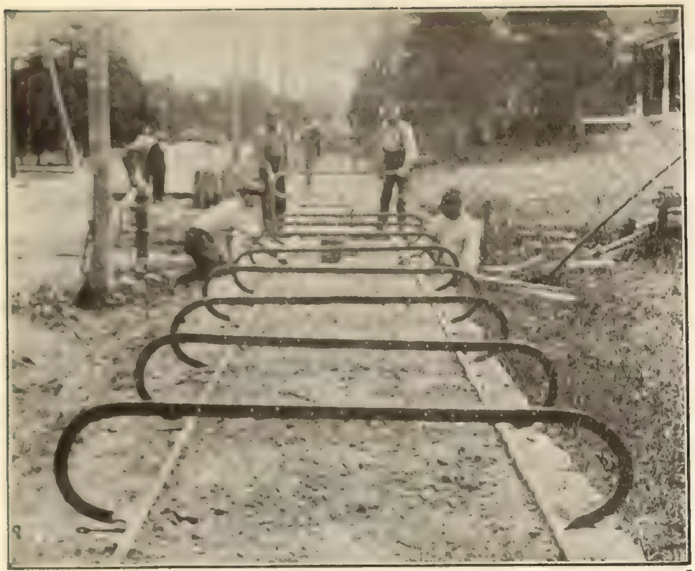

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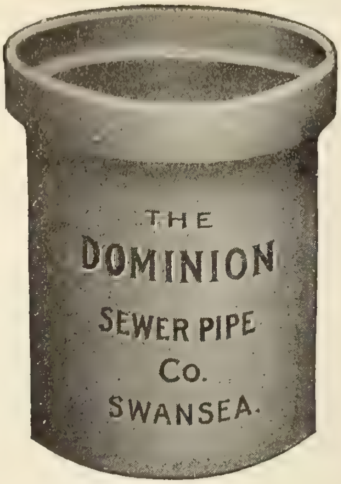

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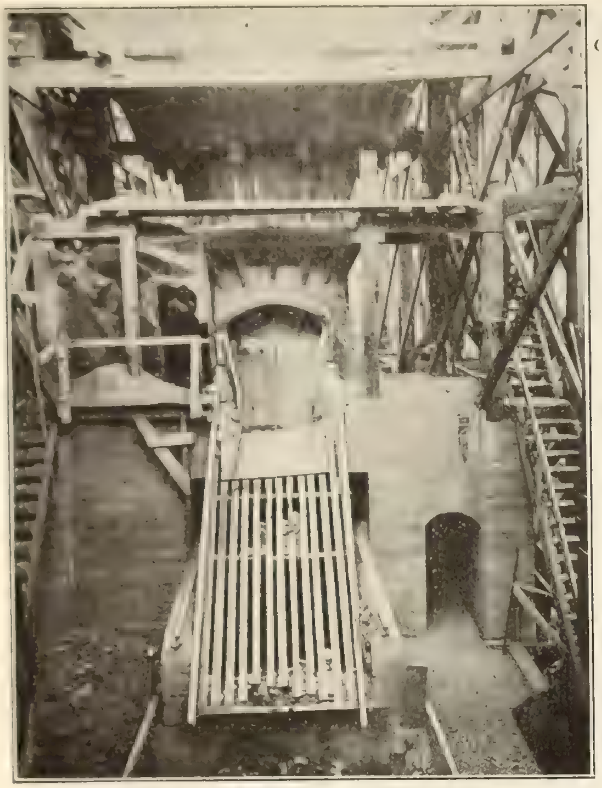

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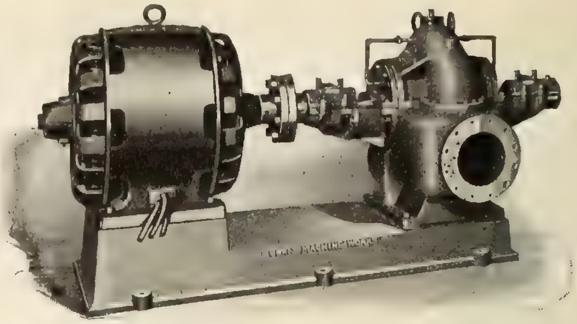

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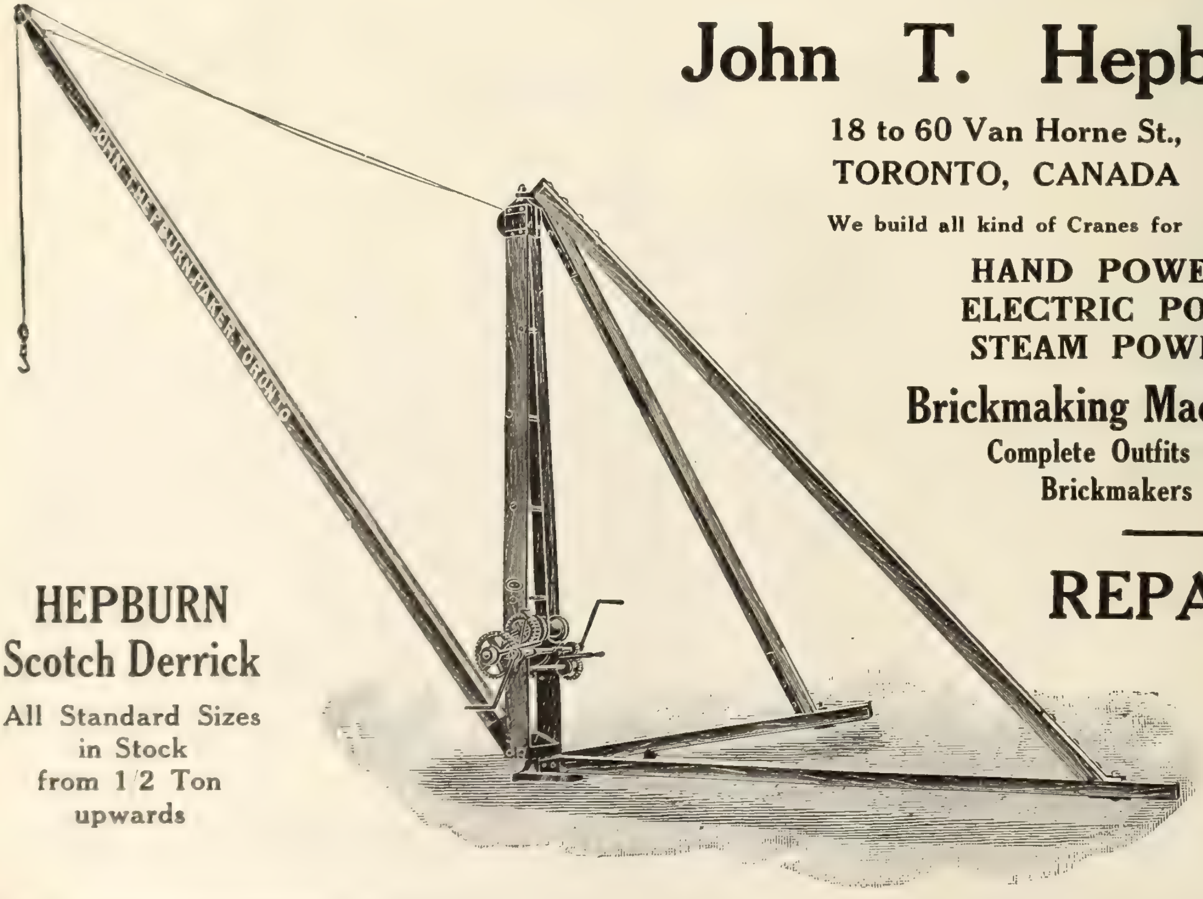
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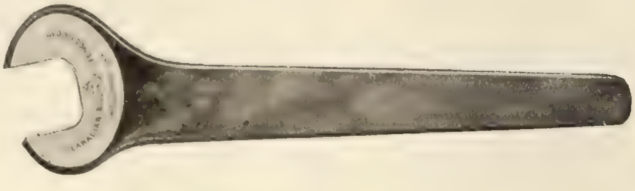

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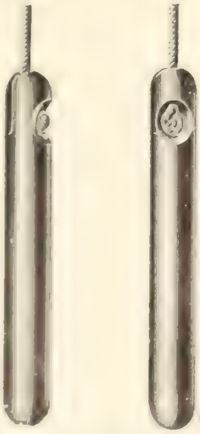

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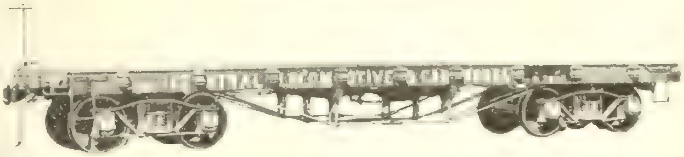

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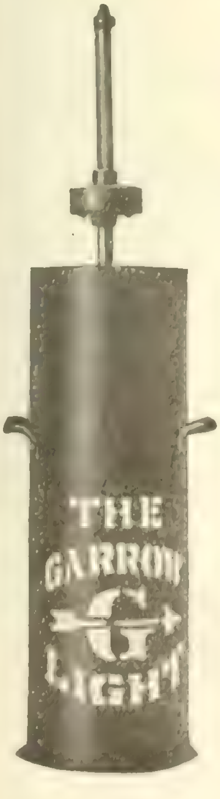

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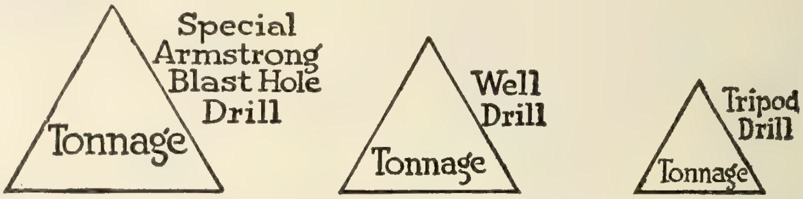

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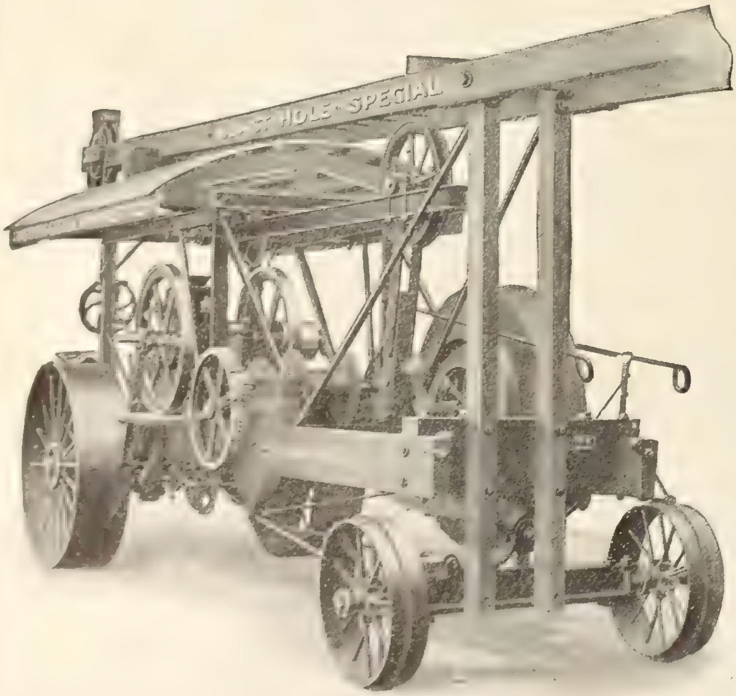

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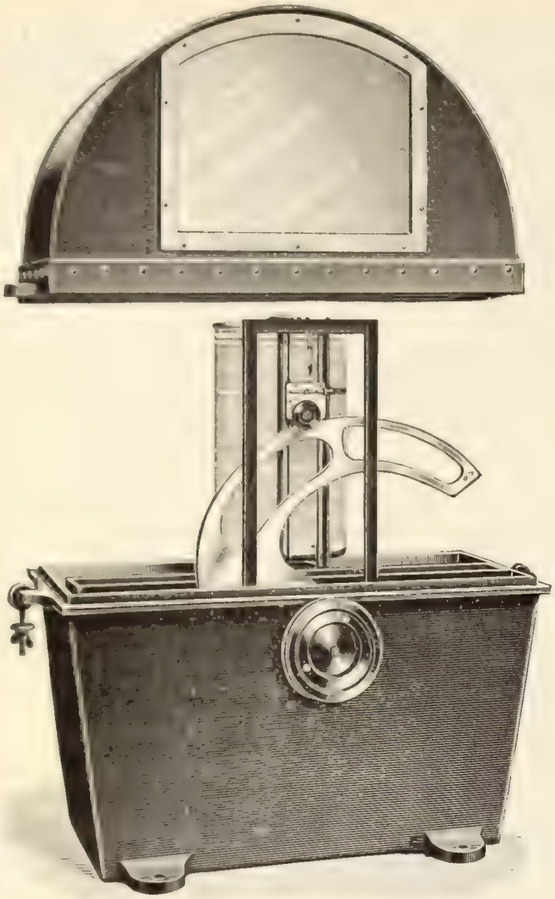

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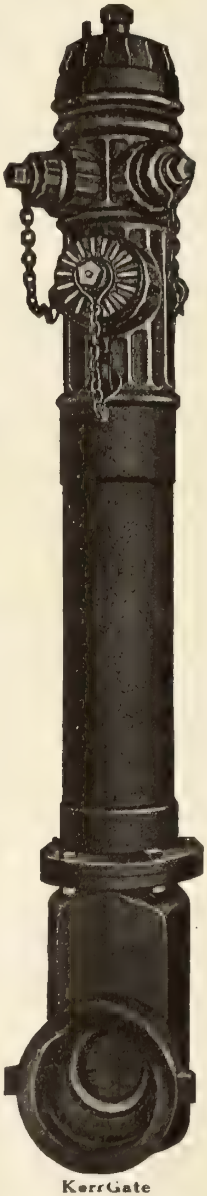

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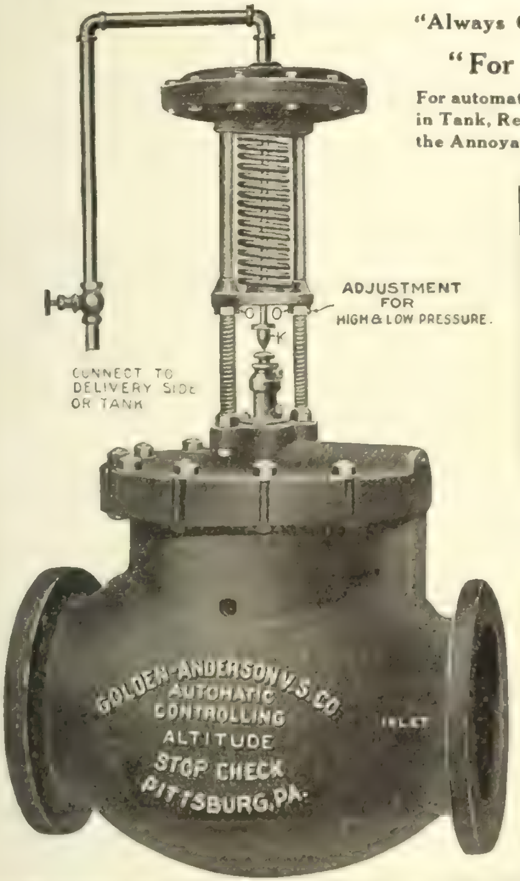
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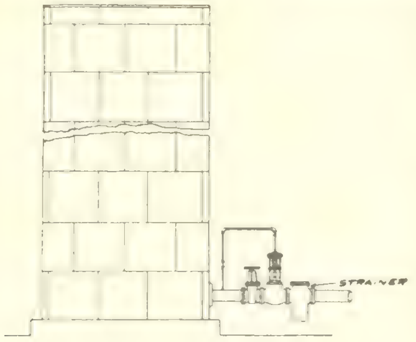

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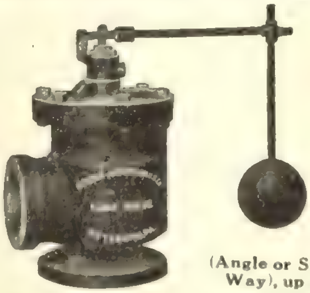

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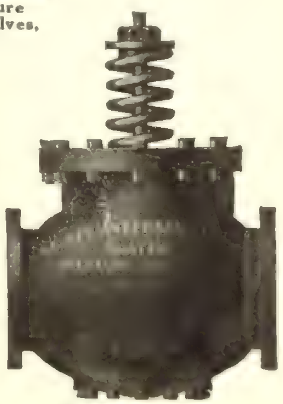

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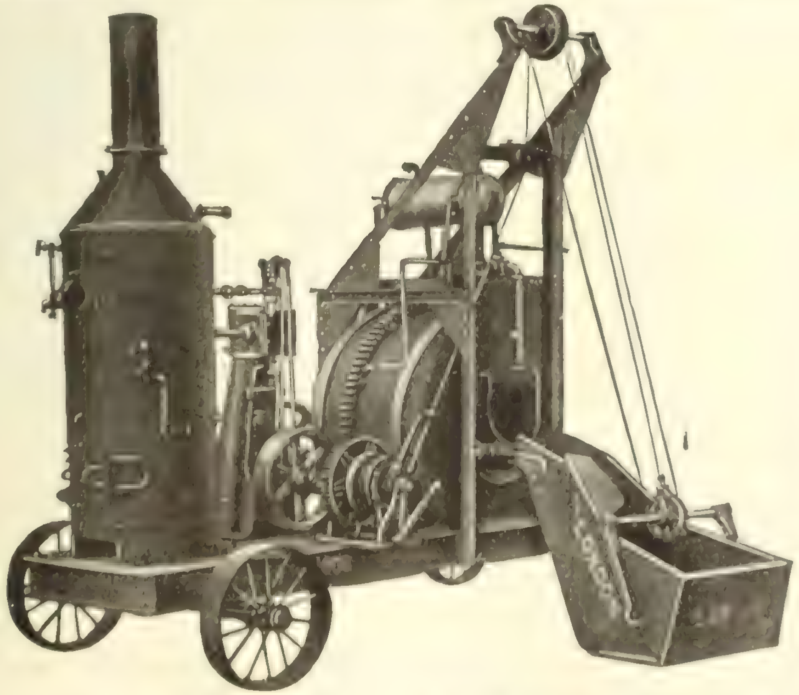

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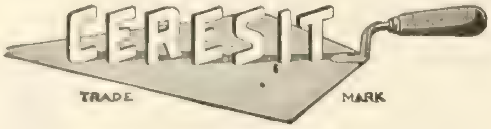

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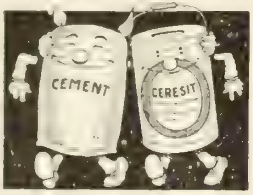

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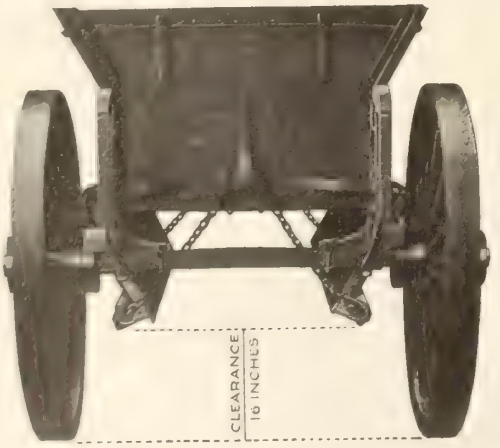

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The MacLean Building

THE accompanying illustration shows the new offices of the Contract Record and Engineering Review in the MacLean Building, 347 Adelaide Street West (corner Charlotte Street), Toronto. Readers are requested to note the change of address. The Telephone numbers have also been changed and a switchboard has been installed to provide a more adequate service. Hereafter all Departments will be reached by calling Adelaide 2700.

The Example of the Dominion Government

WHATEVER bodies may be brought under the levelling influence of adverse criticism during the Empire's present extremity, the Dominion Government must be exempted. The example set by Ottawa stands out in bold relief as one of signal confidence and collectedness. We have the reassuring word that preparations for meeting the exigencies of the coming winter are taking the form of arrangements for continuing work on all the large public undertakings now under way. At the present time these works are giving employment to many thousands, and the importance of the decision cannot be over-estimated. At Halifax there are the extensive terminals of the Intercolonial Railway; at St. John there is the large harbor development at Courtenay Bay; while Quebec, Montreal and Toronto have great improvement schemes in progress which involve the expenditure of many millions of dollars. Then there are the Welland Canal works, the Port Arthur and Fort William construction, and the docks and harbor works at Vancouver and Victoria. The continuation of construction on these enterprises will keep large staffs of men employed and have an appreciable effect upon the circulation of money in the constructional field.

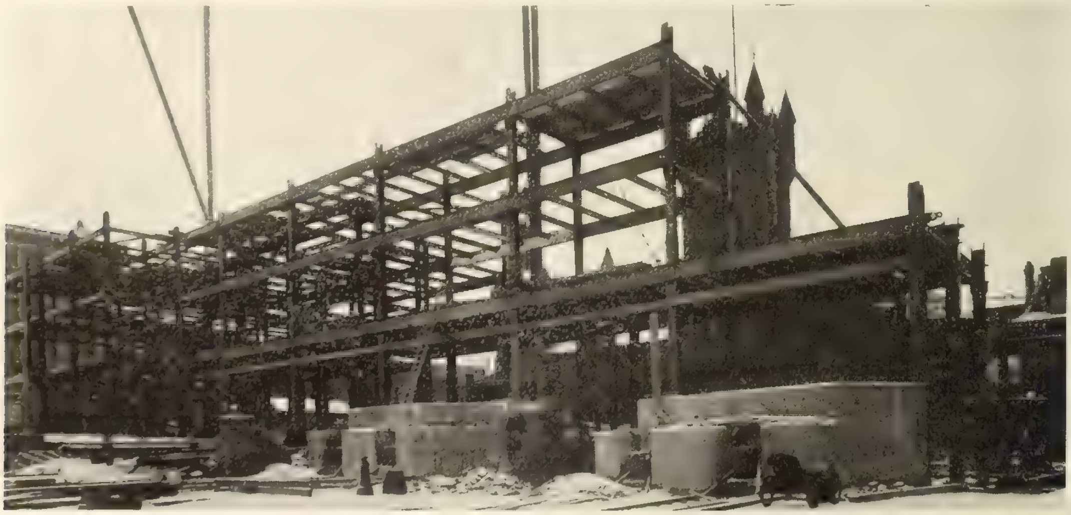
There can be no disguising the fact that many have viewed the situation arising out of the present conflict with something like panic. This has resulted in the needless closure of a great deal of work—a closure which has brought unnecessary loss to owner, contractor and workman, to say nothing of the depressing influence that it has exerted in other directions. Ottawa's example is in direct contrast to this, and the official view represents almost the extreme in optimism. The bank statement issued at Ottawa last week, which covered the first month of the war, is regarded most favorably and the statement for the current month will show the greater extent to which circulation has increased for the maintenance of the country's industry and commerce.

The test of good government is its ability to withstand severe stress. Ottawa has been tried and not found lacking. Its solid front in regard to the maintenance of constructional activity should make an impression upon those of admittedly lesser foresight.

Canadian Pacific Railway Company's New Six-Storey Warehouse at Toronto

Features of Design and Construction in a Building Especially Adapted to the Economic Handling of Merchandise

THE growing resources of the Canadian Pacific Railway make it imperative that adequate facilities be obtained for the operations of the various departments of the system. With this object in view the company has completed the construction of extensive buildings at Toronto for incoming and outgoing traffic, consisting of warehouse and freight terminal. The site occupies the entire space between King and Wellington streets, and the buildings are situated on the southwest corner of King and Simcoe streets. They have a frontage on Wellington street of 951 ft., on Simcoe street of 434 ft., and on King street of 968 ft. On the King street elevation provision is made for future extension to the warehouse.

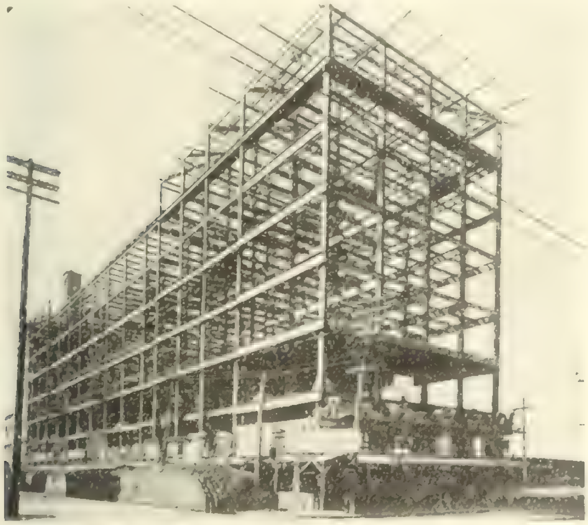


Rear view of Express building, Toronto, showing reinforced-concrete buffers.

Some two years ago freight sheds and transfer platforms were constructed and the present buildings, therefore, complete the company's scheme to provide the required facilities for their operations in Toronto. The new warehouse and freight terminal will handle traffic converging at this point from fifteen tracks and caring for both inbound and outbound freight traffic. The inbound and outbound freight houses have a frontage of 951 ft. on Wellington street, and of 183 ft. on Simcoe street. The section recently added completes a handsome structure, this latest addition being mainly for the accommodation of the Dominion Express Company, operated by the C. P. R.

The buildings are uniform in design. They are of steel frame construction, terra cotta and brick. The exterior is faced with Milton pressed brick, and is finished with Indiana limestone trim, belt course and cornices. The height of the buildings from the street level to the cornice on the King street elevation is approximately 100 ft. They are composed of six floors with two pavilions in addition, which latter in reality form an additional storey. The steel work was carried out by the Dominion Bridge Company. Barrett Specification roofing was employed in the buildings, which are fireproof construction throughout, all exterior work being lined with terra cotta.

The floors throughout are the Roebling construction, 4-in. concrete slab with reinforced wire mesh. The finished office floors are maple, hardwood being considered the most suitable for all conditions. The doors generally are oak, excepting a few which are birch with mahogany finish. All elevator doors are fitted with the Norton check. Access to the Dominion Express Building is gained through one main entrance on Simcoe street. The walls of the entrance and the vestibule are done in Jaunna Royal marble, with Terrazzo flooring and marble border. The stairs, which are ornamental iron, are fitted with cement treads. All windows are heavy plate glass. The ground floor is mainly taken up with freight offices and entrances to the transfer platforms. The first, second and third floors will be used as general offices and the fourth floor as executive offices. The fifth floor has also been constructed for general office accommodation, while the sixth floor will be used mainly as a lunch room for the staff. Each floor is adequately supplied with private locker rooms, etc. The section of the building set apart for the executive offices has been handsomely decorated. Around all the corridors there is a chair rail at a height of four feet from the floor, together with painted canvas dado. The general decoration of the walls is buff, the ceilings being done in a cream color. In a number of the main offices the walls are finished in green, with oak trim throughout, excepting the President's offices and the board rooms, which are birch trim with mahogany finish.



Steel frame, Dominion Express Building, Toronto, as it appeared, April 23, 1914.

Heating is obtained from two Maxim boilers, located in the boiler room beneath the freight offices. Steam is conducted to the warehouse and offices through a subterranean pipe connecting the two buildings. All radiators are fitted with the Dunham trap, with modulating valve. Special attention has been given to the lighting arrangements, which are regarded as ideal. Artificial illumination is supplied by single lights fitted on chain pendants, so spaced that the light is diffused. The window frames and sash on the first floor are kalameined.

View of completed Dominion Express and Freight Offices, C.P.R., Toronto.

The driveways, along Simcoe street, through which access is gained to the various team tracks, are fitted with the Wilson rolling door. The general equipment of the buildings includes the provision of four freight and two passenger elevators. These are the Plunger type, supplied by the Standard Plunger Elevator Company, Montreal.

At the rear of the Express building heavy buffers of reinforced concrete construction have been built at the railroad track terminals.

The buildings combined involve an outlay of more than a million dollars, apart from the cost of laying the tracks and grading work. In point of equipment they are amongst the finest on the American continent.

The general contract for the Express offices, including masonry and carpentry, was carried out by the Peter Lyall & Sons Construction Company, Montreal. Milton Pressed Brick Company, Limited, supplied the face brick and Ontario National Brick Company, Limited, the common brick. The terra cotta was furnished by the Don Valley Brick Works; the reinforced concrete work was carried out by the Crescent Concrete Company, Toronto; the steel was supplied and erected by the Dominion Bridge Company; ornamental iron was supplied by the Dominion Ornamental Iron Company; the marble work was carried out by the J. Gibson Marble & Granite Company, Limited, Toronto; heating, W. J. McGuire, Limited, Toronto; electrical work, E. F. Phillips Electrical Works, Montreal; plumbing, Fred Armstrong Company, Toronto; painting, glazing and decorating, Mr. James Casey, Toronto; roofing, Canada Supply and Contracting Company; metal work, A Matthews, Limited. The general contractors for the freight terminal were the Canadian Stewart Company, Limited, Toronto.

Replacing a 250-foot Reinforced Concrete Chimney

A 250-FOOT reinforced-concrete stack built in connection with the pumping plant of the Torresdale filtration plant on the Delaware River at Philadelphia, is being torn down after it had been replaced by a brick chimney of slightly greater height, built adjacent to it. The reasons for the condemnation were that the stack had an inclination of about 2 ft. towards the pump house; that it swayed about 4 or 5 ins. when subjected to heavy wind pressure; that it was cracked in several places, giving it an appearance of unsafeness; and that it would have wrecked the pumping plant had it blown down in that direction.

When the concrete chimney was built operations had to be rushed so as to get the filter plant ready on time. As soon as the contract had been let in December, 1906, the construction began and the stack was finished May 1, 1907. On days when concreting had taken place the average progress had been about 5 ft. Often the temperature was so low that, when the forms were removed, the concrete had not set, but hung together because it was frozen solid. On other days, especially when the lowest and highest portions were built, the temperature was high enough to permit the concrete to set properly. When the stack was finished the joints between the various stages in concreting were plainly visible from the ground. The concrete, which did not have any coarse aggregate, was mixed in the proportion of 1:3. The sand was taken from a natural deposit close by and had grains from ¼-in. size down.

On the plans and in the specifications it was stated that the stack was to have an offset 104 ft. above the top of foundation. Below this point the outside diameter was to be 12 ft. and the thickness of walls 10 ins. with an interior lining 4 ins. thick and an inside diameter of 9 ft. Between the lining and the outside wall a 4-in. air space was to be provided. At the offset for a distance of 9 ft. the walls were to be 18 ins. thick and above the offset to the head of the chimney 6-in. walls were specified. An ample amount of reinforcement was also specified.

When the stack was razed it was found that the set dimensions had been closely adhered to except for the walls, which were ¾ in. thicker on the north side (that toward the pump house) and ¾ in. thinner on the opposite side than specified. It was also found that the inclination had always been present and that when discovered during construction an attempt had been made to straighten the remaining part to be built. Although the construction joints were plainly visible it was found that the bond between courses was good. The concrete on the north side was found to be the hardest, while that on the south side was the softest. This fact is explained by the supposition that the latter side repeatedly froze and thawed due to the action of the sun, while the opposite side stayed frozen. No concrete work that had been frozen was of a first class quality, but it could not be classified as being directly dangerous. The top part, which had set properly, having been built during April, 1907, was of a very good quality and the progress in tearing it down was only about 3 ft. per day. When, however, the work done during March was reached the progress was increased to 8 ft. per day. In both cases the thickness of walls was 6 ins. except for the head, which was 18 ins. thick and 8 ft. high.

Demolishing the Old Chimney

For demolishing the structure sledge hammers are used to break the concrete in lumps of various sizes. The reinforcing rods are not cut but left sticking up until they can be loosened and thrown to the ground.

The reinforcement consisted of small round rods and square twisted bars of larger sizes. All steel is in good condition, and seems to have been well protected by the concrete.

On the inside of the lining the concrete in several places has sprawled off outside of a number of square twisted bars. This is probably due to expansion of the steel permitting the deformation to act as wedges. Very likely such bars have from the beginning been placed too close to the surface. Flue gases seem to have no disintegrating action on the concrete. Naturally a slight sintering had taken place resulting in a hard interior surface.

As no rungs had been provided on the chimney the matter of climbing to the top of it to begin the work of wreckage was an interesting problem. Two 2 x 4-in. boards 14 ft. long with 1-in. transverse strips served as inclines and chiselled pockets or holes in the masonry served as supports. First one hole about 6 x 6 in. was cut near the bottom of the stack to serve as support for one board which leaned diagonally across the stack. Then the wrecker climbed this ladder, cut a hole in the wall slightly above the opposite end of the board to serve as support for the other piece, put that in place, climbed upon it, cut a new hole and then pulled up the lower piece and placed it in position. In the lower part of the chimney, where the lining was only 4 ins., the holes went clear through, but higher up only pockets were necessary to serve as supports.

During the first day 175 ft. were climbed in this manner, the man in the evening descending a rope by which he was hoisted again the next morning. On the second day at noon he reached the top of the chimney. All told it had taken 14 hours to climb the height of 250 ft. His helper, who was to have been present with a rope and block, failed to appear, so that the climber had to lie down on his planks on the top of the stack and wait until 5 p.m., when finally the rope arrived. A light rope, not sufficient to carry a man, had been brought up by the climber, and by it water and food were sent to him during his long wait. As soon as the rope had been hoisted and the tackle secured the man came down, none the worse for his experience.

The concrete chimney was designed and built by Alphons Custodis Chimney Construction Company; this firm also built the new brick stack and is tearing down the old one. The cost of the concrete stack was $7,500, while the new brick stack cost about $19,000.—Engineering Record.

A Method of Proportioning Concrete

By William B. Hunter*

THE writer submits herewith the results of studies as to a simple method of proportioning the ingredients of concrete so as to insure a satisfactory quality of concrete, and at the same time to avoid the use of an excessive amount of cement.

Several methods for proportioning concrete have been proposed and are in use. These may be outlined as follows:

(1) A careful mechanical analysis of the aggregates and the grading of the same so as to get small percentages of voids, thereby reducing the amount of cement required to a minimum. This may be called the ultra-scientific method.

(2) Arbitrarily fixing the proportions of cement to the aggregates; as 1 part cement, 2 parts fine aggregate, and 4 parts coarse aggregate, commonly spoken of as 1:2:4 concrete.

(3) Adopting a given cement factor—i.e., the number of barrels of cement to be used per cu. yd. of concrete; as a cement factor of 1.80 to 2.10, etc., and adjusting the proportions of the aggregates from time to time to fulfill these conditions.

(4) Determining the amount of cement in excess of the voids in the fine aggregate required to make an acceptable mortar, and the amount of mortar in excess of the voids in the coarse aggregate required to make an acceptable concrete, and then, after determining the percentage voids in the aggregates, proportioning the ingredients so as to fulfill these requirements.

Method 1 may be dismissed without further consideration on the ground of its impracticability.

Methods 2 and 3 are usually satisfactory, and, where the character of the aggregates remains constant, obtain practically the same results as the fourth method. With very little experimenting and the exercise of good judgment, satisfactory results can be obtained. There are, however, objections to these methods, where the aggregates are variable, especially in the percentages of voids contained. For example, assume a 1:2:4 mixture, which is usually expected to give a rich concrete with a considerable excess of cement and mortar over the voids in the fine and coarse aggregates respectively.

---

* Assistant Engineer, Board of Water Supply, New York City.

With 40 per cent. voids in both fine and coarse aggregate, which may be considered as a fair average, with 1 part cement, 2 parts fine aggregate, and 4 parts coarse aggregate, there is an excess of 0.2 part cement over the voids in the fine aggregate, and an excess of 0.6 part mortar over the voids in the coarse aggregate, which gives 4.6 parts concrete.

On a basis of 3.62 cu. ft. of cement per bbl., this gives a cement factor of 1.62. This mixture would give good results, and the cement factor is about what is ordinarily expected.

But, with 50 per cent. voids in fine and coarse aggregate, again with 1 part cement, 2 parts fine aggregate, and 4 parts coarse aggregate, there is no excess of cement or of mortar, and there results 4 parts concrete.

It is evident that it would be very difficult to get satisfactory results with this mixture in many structures, such as conduits, thin walls, etc., where the ratio of the superficial area to the volume of concrete is large, and smooth surfaces are required; and yet the cement factor would be 1.86, which would ordinarily be expected to give excellent results.

Again, with 30 per cent. voids in aggregates and 1 part cement, 2 parts fine aggregate, and 4 parts coarse aggregate, there is an excess of 0.4 part cement over the voids in the fine aggregate, and an excess of 1.2 parts mortar over the voids in the coarse aggregate, which gives 5.2 parts concrete.

It is easily seen that with these last conditions, satisfactory results would be obtained; but the cement factor in this case is only 1.43.

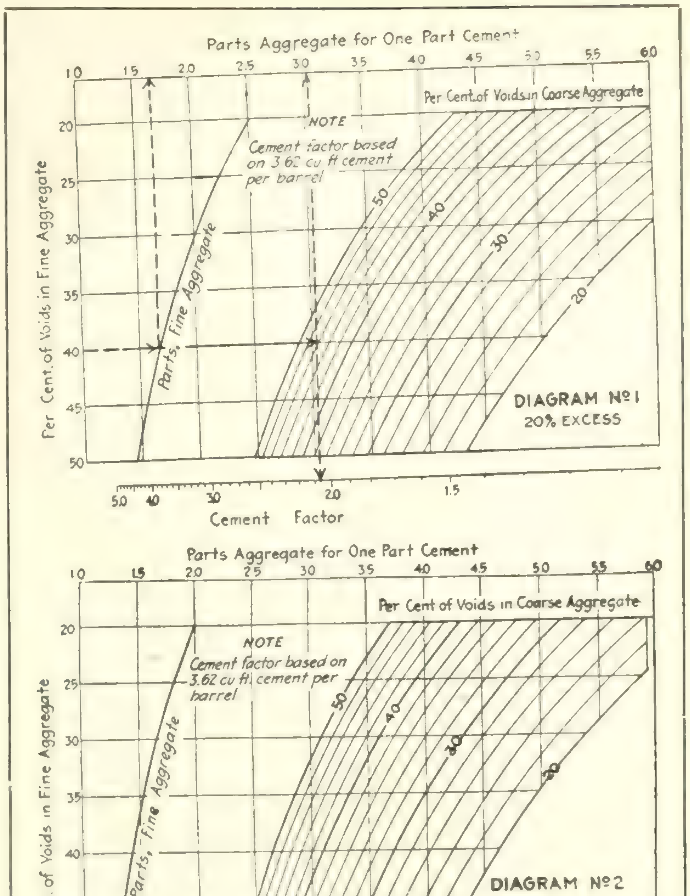
From the above, it is apparent that a high cement factor does not necessarily insure a good concrete, nor does a low cement factor necessarily result in an inferior quality of concrete.

The fourth method is the result of the writer's endeavor to formulate a method which will meet the objections to the second and third, and could be used in conjunction with the first, if it were practicable to impose the conditions of that method. For the purpose of illustrating the use of this method three diagrams are herewith presented.

Diagram 1 is based on the assumption that it is desired to obtain a concrete in which the quantity of cement remaining after filling the voids in the fine aggregate will be 20 per cent. of the gross volume of the fine aggregate, and the quantity of mortar remaining after filling the voids in the coarse aggregate.

Diagram 2 is prepared on the assumption that it is required to have 30 per cent. excess of cement, as previously described, after the voids in the fine aggregates are filled, and 20 per cent. excess mortar after the voids in the coarse aggregate are filled.

Diagram 3 is submitted to indicate the application of this principle where the voids in the fine aggregate can be considered as constant, as is often the case, and the voids in the coarse aggregate are variable. In this case one diagram can be made to cover all percentages for a given percentage of excess cement over the voids in the fine aggregate. The diagram is based on the assumption that the voids in the fine aggregate are 40 per cent., and is computed to give an excess of cement, after filling the voids in the aggregate, of 30 per cent. of the gross volume of the fire aggregate, and 0 to 30 per cent. excess mortar after filling the voids in the coarse aggregate, the voids in the coarse aggregate varying from 20 per cent. to 50 per cent.



Diagrams for determining suitable concrete mixtures.

In diagrams 1 and 2, the curve "parts of fine aggregate" can be used alone where a single aggregate is used.

The accompanying tabulation shows the comparison of results by this method, using Diagram 1, with the standard proportions 1:2:4, frequently used where a rich concrete is required:

Usual proportions	1:2:4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20% excess	1:1.43:2.45	50	50	20	20	2.5

Fixed proportions	1:2:4	40	40	10	15	1.62
20% excess	1:1.67:[illegible]	40	40	20	20	1.86
Fixed proportions	1:2:4	40	30	20	30	1.43
20% excess	1:2:4.8	40	30	20	20	1.30
Fixed proportions	1:2:4	40	30	10	25	1.49
20% excess	1:1.67:4	40	30	20	20	1.55

From this table it will be seen that concrete proportioned on the basis of a given percentage of excess gives uniform results as to the quantity, the proportions and the cement factor varying with the percentage of voids in the aggregates; whereas, with arbitrary fixed proportions, the quality of the concrete and the cement factor vary with the percentage of voids in the aggregates.

Using Methods 2 and 3 (fixed proportions and fixed cement factor, respectively), proportions are usually used which in many instances give mixtures much richer than necessary, in order to guard against getting inferior results from time to time when the aggregates run bad.

The diagrams submitted are merely illustrative of the principle involved, and are not necessarily expected to meet the requirements of any particular class of work, although the 20 per cent. excess diagram would probably give as good results as a 1:1½:3 mixture or a cement factor of 2, and would in most cases require less cement.

Use of Diagrams

Example 1.—To find proportions to give 20 per cent. excess cement and mortar after filling voids in fine and coarse aggregate respectively, when voids in fine aggregate are, say, 40 per cent., and in coarse aggregate are 46 per cent. On Diagram 1, on the left side, find the line representing 40 per cent. voids in fine aggregates; follow this line to its intersection with the curve marked "parts of fine aggregate"; from this intersection follow up to the scale marked "parts of aggregate"; this gives 1.67 parts of fine aggregate.

On the line for 40 per cent. voids in fine aggregate, follow to the right to the intersection of this line with curve for 46 per cent. voids in coarse aggregate; from this intersection, again follow up to the scale of "parts of aggregate." This gives 3.03. The proportions are then 1:1.67:3.03.

To find the cement factor: Read on cement factor scale directly below the last found intersections, and we have cement factor 2.06+.

Diagram 2 is used in the same way as Diagram 1.

Example 2.—To find proportions for 30 per cent. excess cement and 10 per cent. excess mortar, with the voids in aggregates the same as above—i.e., 40 per cent. and 46 per cent. respectively—use Diagram 3. The proportion of fine aggregate is constant in this diagram at 1.43. To find parts of coarse aggregate: On the left side of diagram, on line marked "per cent. of voids in coarse aggregate," find horizontal line for 46 per cent. voids; follow this line to the right to its intersection with curves for 10 per cent. excess mortar; from this intersection, go to the top of the diagram to the scale of parts of aggregates for one part cement; this will give 3.31. The proportions are then 1:1.43:3.31.

For the cement factor: From the intersection of the 46 per cent. void line with the 10 per cent. excess curve, follow parallel to the cement factor curves, and read the cement factor — 2.04 + on the cement factor scale.

In advocating the employment of the percentage of voids contained in the aggregates as an agency in determining the proportions of aggregate to the cement in concrete, the writer is aware that he is proposing a method which has been cast aside by some of the concrete experts. Notwithstanding, he believes that the method herein described is sound in theory and practicability. The writer would further state that in the preparation of the accompanying diagrams he has neglected some small indeterminate coefficients which would not materially affect the results, but which would considerably increase the labor of preparation.

The basis of the computation follows:

1. The effect of the amount of water required to give the mixture a proper consistency in increasing or decreasing the volume is neglected.
2. For the purpose of volumetric determination, the gross volume of the cement is considered as the absolute volume.
3. The volume obtained from given proportions is assumed to be the gross volume of cement and the absolute volumes of the aggregates.
4. The volume of one barrel of cement is considered to be 3.62 cubic feet.

The principal effect of these assumptions is that the cement factors are only approximate, but are believed to be close enough for all practical purposes; and inasmuch as all coefficients are more or less unreliable unless based on experiments with the particular ingredient to be used, it seems best to use none.—Engineering News.

Waves in Road Crusts*

MANY have probably observed the development in bituminous pavements, under traffic amounting to more than a certain minimum, of waves or corrugations approximately at right angles to the line of traffic, and that these waves, where they occur, have an appreciable regularity. This regularity has probably much to do with the suggestion which has been made that such waves be referred to as "harmonic waves," to distinguish them from the more isolated humps and hollows which result from an excess of bitumen in the pavement at one side, or from a settlement of the pavement within a small area, or from something of that nature. Indeed, the theory has been advanced that the harmonic waves referred to may be caused, in many cases, by "harmonic percussion," such as may be set up when a moving heavily loaded vehicle, supported on flexible springs, strikes an obstacle in its path, and attains in its mass a certain rhythmic vibration. This vibration, transmitted through the wheels to the road surfaces, probably produces successive light and heavy stresses in such surfaces, especially when the vehicle is self-propelled. The speaker does not feel that the theory of harmonic percussion is a solution for all harmonic waves, but merely that it is one possible solution of them under certain conditions. He has noticed the appearance of such waves adjacent to an obstacle in the path of traffic when they were not visible away from the obstacle, although the road surface and the road traffic were everywhere, within a reasonable radius, identical. On the other hand, they appear to occur at times when no obstacle such as would set up harmonic percussion is apparent, and in these cases it is quite probable that they are due to excess of bitumen in the road surface, or to improper grading of mineral aggregate for the traffic conditions to be met, or to an improper character of the bitumen, or possibly to some other causes. (Mr. W. W. Crosby.)

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*[Extracts from an informal discussion on "Factors Limiting the Selection of Materials and of Methods in Highway Construction," at a meeting of the American Society of Civil Engineers.]

The speaker cannot accept the theory of harmonic waves said to be due to traffic, nor the beautiful system of harmony of the spheres, for, from practical experience, it has been learned in his department that it is very necessary indeed to watch the output of the mixer carefully. The proportions of stone, of sand, and of asphalt may be all right, but the first run of the mixer will be too rich in asphalt, the middle of the run will be just right, and the latter part of the run will be too lean; consequently, one would have a pavement composed of, for example, 12 per cent., 8 per cent. and 4 per cent. of asphalt, all from the same mixer, notwithstanding that the stone was weighed and measured carefully, as was the asphalt, before either was put in the mixer.

This mechanical failure is often overlooked. It caused so much trouble that the speaker was led to make a careful investigation of the run of the mixer, and it was found that in many cases the asphalt concrete which had been condemned as not being properly mixed owed its lack of uniformity, not to the workmen who were in charge (they had done their duty faithfully and carefully), but to the machine.

In connection with this theory of harmonic waves, there was one very important point made by Mr. Washington which is worthy of more than passing notice—namely, the irregularities caused by improper rolling. The speaker has had considerable trouble in the past, even with water-bound macadam roads. When the causes of the so-called waves are carefully analyzed, it will be found that the trouble lies not in the traffic, but in faulty construction. The first macadam roads built in the United States were rolled with heavy three-wheeled rollers. There never were any waves in those roads. Later, an endeavour was made to reduce the cost of construction, and to that end horse rollers were substituted for the heavy English steam rollers; still later, different types of steam rollers were used, and, last of all, the tandem roller was brought forward as the best. The speaker tried them, and had macadam roads with harmonic waves long before automobiles were used. The real reason for these waves, or hills and hollows, in the road may be found in the method of construction. If the base is not thoroughly compacted, not thoroughly rolled, and not brought to an even and uniform surface, then, if those waves do not appear at once, they will develop eventually. When to this wavy base is applied bituminous concrete which is not uniform in composition, two sets of waves—two sets of hills and hollows—will appear, not due to traffic, but to careless construction.

Highway engineers should not try to dodge their responsibility for poor workmanship by charging it to motor vehicles or to the rhythm with which they travel over the highways when the fault lies in the manner of construction. This must be carefully watched. Careless construction was one of the reasons for the failure of so many penetration roads. The speaker has had experience with penetration roads in which he was told that the distributing wagon had stood for a time at a certain point, and that the hump of bitumen seen on top of the road was due to the fact that the controlling valves were leaking.

In one case coming under the speaker's immediate observation he knew that the wagon had not stopped within 100 ft. of that particular point; therefore the explanation was evidently wrong; hence a series of investigations was made, whereupon it was found that the percentage of voids in the road varied greatly. Where the road was comparatively dense the bitumen appeared in humps on top of it, and disappeared entirely at a depth of 2 ins., and where hollows appeared it was found that the bitumen had penetrated in many cases to the depth of 7 ins. The same quantity of bitumen per square yard of surface having been applied, there was consequently a recurrence of the fat and lean bituminous mixture encountered in the output of the mechanical mixer. A careful analysis of numerous faulty spots, in both broken-stone and bituminous pavements, has convinced the speaker that the varying percentage of voids is a fruitful cause of many so-called failures; in other words, a lack of homogeneity in the mass is the real cause of the wavy surfaces so often seen. (Mr. R. A. Meeker.)

The speaker cannot say much about "harmonic waves" in asphalt or bituminous pavements, but readily agrees with what Mr. Washington has said regarding Mr. Crompton's ideas as to rolling. He believes that waves such as mentioned by Mr. Crompton might occur in some hard homogeneous material, but, with one as plastic as a bituminous pavement, such waves are likely to be due to two causes—lack of cross-rolling and lack of homogeneity of the material. Most highway engineers are familiar with the effect of cross-rolling, and the speaker believes that if roads generally were rolled crossways as well as longitudinally the regular waves would not occur as frequently. No doubt the uniformity of the material, or, in other words, the number of voids in it, has a very great influence on the evenness of wear; and the secret of obtaining a good road, other things being equal, seems to be the even distribution of voids throughout the material. (Mr. D. B. Goodsell.)

The speaker, in company with Colonel Crompton, examined one road on which there were more than 1,000 motor 'buses per day, and found a series of long waves, which occurred with great regularity throughout the length of the road. The speaker believes that improper rolling of the road and the compression of the material are the main factors influencing the formation of harmonic waves. Traffic further develops the harmonic waves due primarily to the vibration of the motor cars passing over them. During the process of rolling it will be noticed that the material rises in front of the front roller and pushes ahead to a certain extent, finally ceasing to move forward, at which time the roller goes over it. If examined, the road surface will be found to have a marked swell. Colonel Crompton has endeavoured to solve this problem by devising a machine with three sets of rollers instead of the ordinary tandem roller. (Mr. Washington.)

The writer thoroughly agrees with Mr. Meeker and Mr. Washington that the so-called "harmonic" waves are caused more by poor workmanship and materials than anything else. On Diversey Boulevard, Chicago, paved with bituminous concrete in 1911, at a section having a mixed traffic of about 5,000 vehicles per day, evenly divided as to direction, one side has pushed into these waves so that it has become exceedingly rough. The other side is quite smooth. This condition is apparent for only about 2,000 ft. The rest of the highway (several miles) is in perfect condition. It is very evident that defective material or workmanship, or both, have been the cause of this. (Mr. P. E. Green.)

Economy and Efficiency in Pavement Construction[*]

By H. B. Pullar[†]

THE economical pavement is a subject of much discussion, but like the proverbial fountain of youth it still remains undiscovered. Many claims have been made for the different types of pavements on the market and almost any promoter, material man or contractor, believes that he can, if given the proper amount of time, convince you that his is the only economical pavement. The truly economical pavement is the one best suited to meet the local conditions which will withstand the ravages of time and traffic with the least possible maintenance, first cost considered.

The old Roman roads with their foundations two or three feet, and in some cases as much as six feet in thickness, were economical roads and pavements for their time, for they not only met the conditions of their time, but have stood the traffic of centuries. To build a Roman road in modern times, however, would not be economical or wise. An American administration attempting to lay a Roman road would probably not only start a vigorous protest of abutting property owners but would find a quick demand for a change in administration. While the history of the old roads of the Roman Empire, France and England, is interesting and they have been of great service in the development of modern type of pavements, they can no longer be used as models.

Americans, with their nervous, progressive and energetic spirit, must solve their own paving and road problems to meet their own particular conditions.

The principal considerations in determining the economical pavement are the traffic and climatic conditions to which the pavement must be subjected, available materials and their cost, assessed valuation of abutting property, and the probable result of the improvement.

Before a pavement is laid the climatic and traffic conditions should be given most serious consideration and should be a big factor in making the final determination. In the large cities where traffic is heavy, granite or wood block are very largely used. This is because these two types of pavement have been found to withstand heavy traffic more satisfactorily. Where the question of excessive noise is not material, the long life and small difference in cost, and the ease of repairs and low cost of maintenance, make granite block the favorite; while on a heavy traffic street lined with office buildings or stores, where the question of noise must be taken into consideration, wood block is constantly increasing in favor. It would be folly indeed to lay a concrete pavement, bituminous or water bound macadam, or any other cheaper type of construction under such conditions. In considering the traffic conditions to which a pavement must be subjected it is always necessary to take into consideration the probable increase in traffic after the pavement has been laid, and in many instances it is advisable to take traffic census for the proposed improvement. It is not uncommon for the traffic of a road or pavement to double in volume after the improvements are made.

Another very important matter in considering the traffic conditions, is the kind of traffic. Where horse-drawn traffic prevails, a pavement should be made to aid this class of traffic; and where motor traffic prevails, a different type of pavement entirely may prove to be the most economical. Probably one of the best examples of this kind can be cited in Wayne County, Michigan. Almost everybody interested in paving has heard more or less favorable comments as to this large mileage of concrete roads. Cement manufacturers and promoters have advertised these roads from one end of the country to the other, but in trying to convince you that concrete roads will be the most economical pavement for you to lay and in telling you about these Wayne County roads they usually forget to give all the facts, and fail to realize that because in Wayne County or some other place concrete has given successful results, it will not necessarily prove to be successful for your own work. The traffic on the Wayne County roads has been reported as being over eighty per cent. motor traffic, and a large per cent. of this motor traffic is pleasure vehicles. The roads are and have been constructed by the most up-to-date methods and repairs are made immediately any defects appear. Were these conditions reversed, and the concrete roads in Wayne County compelled to withstand over eighty per cent. of horse-drawn traffic or even a much higher per cent. of heavy commercial car traffic, they would probably not prove to be the most economical, and the reported low cost for repairs and maintenance would be considerably increased.

Climatic Conditions

Climatic conditions should be given consideration when determining upon the most suitable type of pavement. In England it was found that asphalt pavements laid similar to those in America deteriorated very rapidly, and the cause was found to be the heavy fogs. A higher percentage of asphalt was used to overcome this trouble and more successful results were obtained. The southern part of this country requires a bituminous material of different consistency than that used in the northern section.

Bituminous pavements to give most successful results must have suitable drainage, and while this is true of other pavements it is specially true of all bituminous work. The climatic conditions of Michigan permit the use of many and various types of pavements, and they are not as important a matter as in other parts of the country.

The availability of materials is often given but slight consideration in determining the type of pavement to be constructed, and yet it is of the utmost importance in some localities. Where good sand is available at a low cost and where other conditions are equal, how foolish it is to import brick from another state in preference to laying sheet asphalt pavement, which is composed of about eighty per cent. of sand, whereas the reverse would be true if it were necessary to import sand into a town in which there is a brick plant turning out high quality brick. There are conditions in different cities which make it advisable, even at a much higher cost, to favor one type of pavement over another, but where the truly economical pavement is desired and other conditions are equal, the availability of materials should be given careful consideration.

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[*] Paper presented before the League of Michigan Municipalities.

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In determining the most economical pavement the assessed valuation of the property is too often considered to be of minor importance, and politics and real estate promoters are frequently the cause of sheet asphalt pavements being laid out in the country, while the old unreliable water-bound macadam pavement remains in the heart of the city. We find many instances where expensive wooden block pavements are laid on light traffic residence streets with heavy assessments made against the abutting property owners, who can ill afford them, while in the main business streets a cheaper type of construction is used with a heavy maintenance coming out of the general taxation fund. This practice is certainly contrary to all ideas of economy, and there has been much waste of publis funds in cities where such conditions exist. A careful consideration of the needs of a street and the assessed valuation of the abutting property will not only result in better streets, but will cause a much lower general maintenance charge on all paving in the city and a more equal and just distribution of the paving fund.

The medical profession, with its great scientists and students, is continually finding new cures for what have been previously considered incurable diseases. Likewise the engineering profession, by its scientific studies and research work, will continue to overcome the numerous and difficult problems of paving construction. The economical type of pavement is distinctly an engineering problem and its solution for any particular street or locality will depend upon the efficiency of your engineer. The time is coming when the city engineer will be given more authority to direct and more opportunity to study and work out to advantage his paving problems. A successful manufacturer would soon lose his business and turn his dividends into losses were he to employ a new superintendent each year; as he would, also, if he should employ a capable superintendent to look after his business and then only spasmodically assist him in his work, or fail to give him authority to go ahead. So the choice of the economical pavement must be left with a capable engineer, receiving a big compensation and with full authority to direct his work, and in this he should receive the co-operation and help of all officials and citizens.

Coming Types

While I have endeavored to give you a general idea as to some of the important features to be taken into consideration when deciding upon the economical pavement for your city or town, I will endeavor to give you a short description and history of what we believe to be one of the coming types of economical bituminous construction. This is known as the open type of asphaltic or bituminous concrete.

With the advent of the automobile and the demand for a more permanent type of construction than the water-bound macadam, the bituminous macadam laid by the penetration method was one of the first to be considered and has been most extensively used. For a time it seemed to have solved the problem, but failures have been too frequent and costly. While there are many good bituminous macadam roads which were constructed by the penetration method, the many small details which must be carefully looked after in order to get successful results have made the proportionate chances of failure so numerous that it is always with more or less uncertainty of results that a penetration job is constructed. The principal causes of the failure of bituminous pavements laid by the penetration method are the impossibility of thoroughly coating each particle of stone and the segregation of the stone, making it impossible to obtain an even distribution of the bituminous material. The result of this is that there are numerous spaces in the road which allow water to penetrate, causing the pavement to disintegrate rapidly.

Bituminous Concrete

Another type of bituminous pavement which has found great favor, is the bituminous concrete, which is a mixture of asphalt, sand and stone. This type of pavement would find greater favor were it not for the fact that certain patents to cover practically all mixtures of stone and sand have been held valid in some of the courts; and on account of the undesirability of getting into any patent litigation cities have hesitated in adopting this type of construction.

Because of the uncertainty as to the results obtained from the penetration work and because of the desirability of getting a cheaper type of bituminous pavement than the asphaltic concrete or sheet asphalt, the open type of asphaltic or bituminous concrete has been developed and has met with much favor in different sections of the country. This type of pavement, however, is not a new one, having been used many years ago with a tar binder. The pavement consists of a mixture of stone and bituminous cement acting as a binding medium.

The stone is heated to a suitable degree of temperature, depending upon the bituminous material used, and then mixed with bituminous binder in suitable proportions. It is laid similar to sheet asphalt or asphaltic concrete. The mixture is laid from 2 to 3 inches in thickness and properly rolled. After rolling there is applied a squeegee coat of pure asphalt cement and while the coating is still hot stone chips are thrown over the surface. The whole pavement is then re-rolled so the squeegee coat is forced into the voids, making a tight, uniform, waterproof and durable surface. Heating the stone and then mixing in asphalt so that each particle is thoroughly coated, prevents the trouble which causes so many failures in the penetration method and prevents any segregation of stone.

The city of Lansing last year tried out this type of pavement on some of the principal streets with most excellent results at a very low cost. On account of the results obtained at Lansing, the State Highway Department of Michigan will put in a strip of this same type of pavement in Oakland County, which is an extension of the Woodward Avenue pavement of Detroit. This section of pavement will join the concrete road of Wayne County and will afford an excellent opportunity for a comparison of the two different types for the same traffic. There are a number of other cities in the state which have already laid considerable yardage of this open type, and which contemplate laying in the future a large amount of this work.

The open type of asphaltic concrete pavement free from infringing on any patents, thus removing any cause for litigation. Although there are about 35 per cent. of voids in the mix as it comes from the mixer the stones key in together giving the wearing surface stability, thus preventing shoving and rutting. In fact, the finished pavement is similar to water-bound macadam with the exception that each stone is bound together with asphalt cement. The asphalt cement prevents any dislodgement of the stone from either horse-drawn or motor traffic.

The first cost of this pavement is very nominal compared with other types, being slightly higher than that of the penetration and considerably less than the closed type of bituminous concrete or sheet asphalt. With the average conditions in Michigan these pavements can be laid by contractors for from $1.10 to $1.40 per square yard, including 6-inch concrete foundation, but if the pavement is put in by the day labor plan, under the supervision of the city engineer, the cost should be considerably lower. In fact, I believe the total cost of the paving at Lansing did not exceed $1.10 per square yard, and the city used crushed cobble stone instead of limestone, which added considerably to the expense.

The open type asphaltic concrete pavement, after traffic has been on it for some time, looks almost the same as the closed type, or like bitulithic. It is easy to repair, pleasing in appearance and makes a sanitary and noiseless pavement. There many cities and towns throughout Michigan, especially in the residential sections, where this type of construction would be advisable. I think it would prove to be the economical pavement and I believe that it will constantly grow in favor with engineers and officials in charge of paving work.

There is another item to be taken into consideration in discussing the economical pavement. No type of construction and no materials, no matter how high the quality or how successful they have been in other places, will be satisfactory in any locality unless they are properly constructed. Just because a pavement or a particular type of construction has given successful results in one town or one locality is no indication that it will be equally successful in your city or town unless every precaution is taken to see that the numerous small but important details are carefully looked after. The best of materials cannot give good results unless properly handled, while better results can be obtained with poor materials properly applied.

It is not, by any means, always economical to award the contract to the lowest bidder and a difference of 5, 10, or even 25 or 50 cents per square yard in the original cost may in the end prove most economical.

In conclusion, I would state that the economical pavement of to-day is not any particular type or any particular material, nor is it a pavement put in at any particular cost. It is a pavement carefully selected after an exhaustive preliminary examination by an efficient engineer to best meet the demands of the particular locality in which it is to be constructed. It is a pavement laid in direct accordance with the requirements of carefully prepared specifications, which should be reasonable and just to both the city and contractor. It is a pavement in which only the most suitable available materials for its particular type of construction are used; a pavement laid under the direction of an efficient and capable engineer, with authority to direct and supervise the many details of construction and to appoint inspectors for their efficiency and ability to carry out his orders, rather than for their ability to obtain votes at the next election. The city or town in which this condition exists, while it may continue to have a failure now and then, and while it may not find the one economical pavement, will come nearer to solving the problem and satisfying the tax payers, to whom all public officials in the end must look for commendation.

The Meaning of "Macadam"

By Major W. W. Crosby*

GENERAL agreement as to the meaning of the word "macadam"—commonly used to refer to a type of road surfacing—would prove of great convenience. The writer does not know that there is at present much diversity of opinion as to what is covered by the term, but it has been stated to him that no general agreement has been reached on this point; that in more or less numerous cases where experience has been limited to the use in construction of, say a few kinds of broken stone, it seemed that little, if any, thought had been given to arriving at the limits of meaning of the term "macadam," it being granted that it applied to the work in hand; and that accordingly it might be wise to discuss the possibilities of its definition and to suggest one such as a concrete starting point for the discussion.

Any definition of "macadam," meaning a type of road surfacing, which limits the material to be used for its construction to crushed stone would, the writer thinks, be too narrow to be either correct or convenient. McAdam, the engineer from whose name the term is derived, himself used no "crushed" stone nor did he confine himself even to broken stone. He specifically refers, in his "Remarks on Road Making" (London, 1820) to the use of "gravel," "flint," "limestone," "whinstone" and "large pebbles mixed with sand," and says: "Excellent roads may be made with any of these materials." Then he later lays down certain principles for the use of "different materials," condensed extracts from which are quoted below in the order he gives them:

> The size of the largest pieces of road metal should not "exceed an inch in any of its dimensions."
>
> The road (i.e. road crust) ought to be considered as an artificial flooring or roof over the foundation, which latter really carries the bonds and to that end, must be kept dry.
>
> The admixture of earthy or other fine material to broken stone is injurious and a mechanical bond or interlocking of angular pieces of road metal is necessary. This should not be discouraged or interfered with by the presence of fine material.
>
> The road metal should preferably rest on a firm, but resilient, foundation, rather than on a hard rigid one such as ledge or rock paving.
>
> The thickness of the road metal should be no greater than necessary to preserve its integrity as a roof to keep the foundation dry.

Throughout the whole book may be found many references to the use of gravel by McAdam, his criticisms of it as well as of various stones, and his suggestions for the use of each.

The point the writer wishes to make is that our term "macadam," considering its derivation, means the attainment of certain results based on the observance of definite principles rather than the use of particular materials or methods.

McAdam had no steam rollers, no stone crushers, and the available materials for his road metal were limited to stone and gravel. Had good slag, for instance, been as available then as to-day, is it reasonable to suppose that so practical a man would have ignored its possibilities?

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It seems to the writer that if we recognize the principles of McAdam, referred to briefly above, and also the wider resources for both materials and machinery now open, a proper definition of our term may be made as follows:

> Macadam is a road crust composed of gravel, shells, slag, broken stone, or similar materials, in which the largest particles do not exceed a certain maximum size (dependent in any case, to some extent on the quality of the material used but generally about two inches for the longest dimension), whose particles, having a size preventing their passing a ¾-in. ring, are compacted together so as to be interlocked and mechanically bound together to the utmost possible extent, and whose then remaining voids or interstices are filled, by the aid of water, with smaller particles and fine material from the same or similar sources. True macadam has no particles in the surface exposed to travel whose size is so great as to render them unstable under horse-drawn vehicular travel. Macadam built on top of an artificial foundation of paving is usually called "Telford" or "Telford Macadam."

In case a general acceptance of such a definition is had for "macadam," several related or subsidiary terms may be most conveniently used with an increase of clearness in their use.

For instance, "shell road" may be used to designate a road surfaced with dredged shells which are generally mixed with sand, silt, etc., while "shell macadam" would differentiate the surfacing built with clean shells, compacted and then filled (as to its voids) with only the necessary amount of sand or fine material. "Gravel road" would mean a road with a crust of unscreened or "bank" gravel, while "gravel macadam" would indicate the adherence to the principles of McAdam. A "slag road" would be built of slag from the pile, unscreened. "Slag macadam" would indicate that breaking and screening the material had taken place in some way. Further along this line, the term "bituminous gravel (or shell or slag or broken stone) macadam" would then logically be a most convenient term for differentiating such a surfacing built by the penetration method from one built by the mixing method (a "bituminous concrete").

It seems to the writer that it is up to highway engineers to adopt promptly such reasonable nomenclature in their work as will indicate by its saving of breath and ink their appreciation of the engineering demands, as well as those of the times, for efficiency.—Good Roads.

Value of a Library in an Engineering Office

Arguments in Favor of Converting the Dusty Pile of Pamphlets and Periodicals into a Central Bureau of Useful Information

By L. B. Krause

WHY should an engineering firm build up an office library? The answer to this question is almost unanimously agreed upon by professional men of highest standing, and the reasons why may be briefly stated as follows:

First. The success of engineering work depends on accurate information, for information is as necessary a tool in the examination, design and construction of engineering enterprises as the mallet and chisel are in the work of an artisan. A knowledge of the experience of others, gained through the medium of print, is invaluable in producing the best results to be achieved in any line of work.

Second. The competitive element in modern business requires that everyone should know, if possible, what everyone else is doing, and the best way to find out is by means of printed information.

A prominent engineer, head of an industrial laboratory, recently stated in an address that industrial laboratories "should each one be developed around a special library, the business of which should be to collect, compile and classify in a way to make instantly available every scrap of information bearing upon the materials, methods, products and requirements of the industry concerned"; while a noted water supply engineer, writing upon the work of a consulting engineer in a recent periodical, states that the consulting engineer "should have a specialized library of all waterworks literature, carefully filed and indexed for ready reference, and that if he be wise he should expend a good deal of time and money in tabulating data, forming a data file for ready reference on all of the more independent subjects that are likely to come before him."

Methods of Building Up an Office Library

Taking it for granted, therefore, that engineers in general are convinced of the value of collecting printed information bearing upon their particular lines of work, the more serious and vital question is, How can this information be most economically collected and efficiently administered? Or, in other words, What are the best methods of building up an office library?

The first step in the building up of an office library is the concentration or collection of all the printed material available in the office in one place. This is exactly what is not done in a large number of offices. Books, pamphlets and other information are scattered among the various members of the organization, who treat them as personal property and preserve them in their private desks as carefully as a squirrel hides his store of good nuts. The policy in many offices in regard to information seems to be to hang on to everything of value for one's personal use, regardless of how much value the information might be to another member of the organization and also regardless of the fact that the material has been paid for out of company funds. The ethics of such procedure is exceedingly questionable, for it certainly is self-evident that both material and time which are paid for by an organization should be used for the best interests of the organization as a whole.

Too much emphasis cannot be placed upon this first

Librarian, H. M. Byllesby & Company, Chicago.

principle of the successful office library, namely, that all material should be shelved in one place, making it of equal access to all members of the organization.

Technical Periodicals and Indexes

The next important step is the proper preservation of technical periodicals. The failure to preserve, by binding, files of valuable periodicals is another sin of omission to be laid at the door of many offices. Single numbers are lost through the carelessness of the office force or are rendered useless by items having been cut out according to the interests of the various readers. It is certainly legitimate for a man to clip or lose the copies of a periodical for which he personally subscribes, but it is certainly not legitimate for him to mutilate a file which should be preserved for the benefit of the whole office.

The question has arisen whether it is not more advisable to cut up periodicals and preserve only articles of special interest than it is to bind the volumes, which take up more shelf room. While it may be advisable to clip certain articles of interest from miscellaneous journals whose general run of material is only of occasional interest or value, on the whole the practice of clipping and filing only portions of the best technical journals is a short-sighted policy and not an economical or efficient one for an engineering office. No engineering office is prophetic enough to foresee exactly what information needs to be cut out and preserved for future use when one considers the variety of valuable material found each week in the leading technical journals.

Something may be said in favor of articles being clipped for a personal file by individual engineers who subscribe only for two or three journals and whose range of interests is bound to be more limited than those of a whole office staff. One of the best filtration engineers in this country has for years cut up the Engineering Record and mounted certain articles on stiff manilla sheets and filed them by subjects in pamphlet boxes. But even in such an individual case is there not danger of a need for information arising which an engineer has not foreseen and in which a bound file of a periodical would prove invaluable? There must be taken into consideration also the time consumed in selecting, clipping and filing, which would be eliminated if the volumes were bound. If aid is needed for quick location in the bound volume of special articles of interest, a brief subject-card index can be easily prepared.

In addition to binding up sets of periodicals for the office library there should be purchased the general indexes to technical periodicals, as the "Engineering Index Annual" and the "Industrial Arts Index," and any cumulated indexes to the individual journals of which the office has a file. These general indexes will, of course, give references to many periodicals not in the office library, but they render the valuable service of directing attention to information not at hand but which can be easily procured from the large public or engineering libraries of various cities.

What to do With Pamphlets

Every engineering office receives a quantity of pamphlet material which is either not preserved or which soon grows into a dusty pile of unsorted material. There are only two ways of disposing of a pamphlet—either put it into the wastepaper basket or treat it as worthily as a book, for the value of any pamphlet is not to be determined by its size or binding but by the quality of the information which it presents. The chief objection to a pamphlet, no matter how valuable its information, is its lack of durability; the leaves are generally poorly fastened together and it soon becomes dog-eared and torn. Two methods of preservation may be used—either put each individual pamphlet into a binder, such as the Gaylord pamphlet binder, or use pamphlet boxes in which to group pamphlets on certain subjects and stand them on the shelves with the books treating of the same subjects. Individual pamphlet binders are, in the opinion of the writer, to be preferred, as they give a pamphlet a stiff cover, which makes it more neat and durable. The general rule governing the care of pamphlets should be that a pamphlet worth keeping should be treated just as a book is treated.

The vertical file has been used for taking care of pamphlets, but it seems to the writer more advisable to bring all material on a subject together on the shelves than to have it filed in two places. The vertical file is the best method of filing manuscript and typewritten data which supplement the material found on the library shelves but which cannot be conveniently put upon the shelves, because of their form.

Other Material to be Included in the Library

The library in an engineering office should never be limited to collecting books and pamphlets only, but should be built up in accordance with the broadest idea contained in the word library, namely, information of all kinds in any form which may be useful in the work of a particular organization. This means not only books, periodicals and pamphlets, but also photographs, trade catalogues, manuscript data of general interest, specifications, and valuable notes accumulated in connection with the specific work of the organization. It is a lamentable fact that the work of many offices is handicapped by want of co-operation among its members, shown in a selfish withholding of information by which "the other fellow" could profit and to which he is lawfully entitled. There is also a tremendous waste of both time and experience, which means money, due to the failure to put on file for future reference all data which have been accumulated in years of study and work by the employees of an organization. In some cases where an effort has been made to file such data their future usefulness has been reduced to a minimum by want of an adequate system of filing under competent supervision.

It is a self-evident fact that only continuous and competent supervision can assemble and make valuable such a variety of information. It cannot be done by the average office helper, either office boy or stenographer, and it is not economy to use the services of one of the engineers, whose time is more valuable along the line of his special knowledge, and who, also, has no familiarity with methods of library work. The failure of many engineering offices to realize the value of building up a library is due to the fact that the work is put into the hands of someone in the organization who does not know how to collect information or how to make it quickly available after it is obtained. The office stenographer who is busy with other work has not the time, nor does he know how to do it even if he had the time; while the engineer who is competent to pass upon the merits of the desired information after it is obtained does not know in many cases just where to get the information from outside sources. The writer knows of concrete instances in which engineers whose time is worth a large sum per day have spent a number of hours in locating technical information which could have been found in a much shorter time by a trained librarian, the cost of whose services by the month would have been equal only to the market value of the expert engineer's services by the day.

"The Librarian Knows How"

The argument for the employment of a trained librarian can be briefly stated in four words—the librarian knows how. The librarian knows how to procure valuable information contained in Federal and State reports, knows how to keep up with the literature of the engineering profession and how to obtain desirable printed data which cannot be purchased and which must be obtained from private sources. The librarian knows how to use all kinds of indexes, how to use quickly the facilities of large city libraries, how to catalogue and index according to standard practice, so that no time or money is wasted in experimenting with original systems; and last but not least, always has a place for everything and everything in its place. The librarian also makes a business of knowing about all the work of the office and co-operates with each department in touch with what another department is doing. The librarian also keeps up with the field of print, which the engineer is too busy to look over for himself, posts him on what he ought to know, and, in brief, becomes to the office a walking guidepost and a living index.

Should the question arise as to whether there is work enough in any one office to keep a librarian busy (a condition which the writer seriously doubts), it might be well to state that the educational qualifications of librarians make it possible to use them on a variety of work.

In conclusion, it may be stated that it seems a short-sighted policy for a large engineering office to fail to add to its staff a librarian who can make readily accessible information of inestimable value in the successful prosecution of its work.—Engineering Record.

Control of Reinforced Concrete Construction

By W. K. Hatt†

A NUMBER of casualties have attended construction in concerte. A sudden collapse of a portion of a reinforced concrete building in a large city, attended with loss of life of workmen, generates in the public mind a fear of concrete construction; and a prospective builder is likely to resort to a less permanent and less fitting style of building because of the uncertainty. He knows that a concrete building is serviceable and permanent after the cement has set, but he fears the risk arising during construction.

Structural engineers on the other hand know that the percentage of failures is small, and the accidents to be avoidable.

Dangerous conditions in reinforced concrete construction arise from (1) inadequate designs; (2) defective materials, and (3) unfavorable weather conditions and lack of care under those conditions.

All of these elements may be, and are, controlled in the larger cities by building codes and active inspection. For instance, in the city of Chicago, which has an unusually efficient and watchful building department, there have been no serious failures of reinforced concrete buildings under construction. In this city designs are checked over very carefully to see if they conform with the conservative practice established by the building code of that city.

It is in the smaller cities, that are large enough to demand permanent buildings but without building codes, that the most dangerous conditions obtain.

The building codes are thought to be too conservative by some designing engineers of companies interested in the sale of materials. For instance, while these codes generally permit 16,000 pounds stress per square inch upon ordinary reinforcing steel, some designers will increase this to 20,000 pounds where the code does not prevent, and under circumstances where the sale of the material depends upon a low total price.

Many buildings have been erected under designs that are not conservative and are today giving good service. Their construction has been under favorable conditions with reference to cement, sand, weather conditions, and skill of workmen; and the lack of factor of safety in design has been counter-balanced by the increased factor of safety in materials.

Codes, however, must recognize average conditions. The architect or structural engineer or commercial firm supplying material, who has drawn upon the factor of safety in design, and then has met unexpected conditions in the materials, weather conditions, etc., and has a failure on his hands, is certainly in a weak position.

The larger number of failures of concrete buildings occur during the late fall when the low temperature and wet weather prevent the cement from hardening properly. At this time, too, the owner is anxious to get in the building. Every one is in haste; forms are struck before the concrete is hard enough to support the floors above; the roof, which is often the weakest part of the design, is being covered with cinders, into which the rain seeps. Instead of weighing 45 pounds per cubic foot, the weight of these cinders may run up to 100 pounds per cubic foot. Then, too, the plumber may seriously overload a portion of the floor with piles of pipes, may even remove a form support. Under these conditions it is no wonder that failures occur. In the presence of these unfortunate failures a designer who has furnished a conservative design is in a strong position.

The writer has investigated and made reports upon several failures in which it has been necessary to criticise the design. In some of these cases the architect has originally made a conservative design with sufficient materials and proper connections. The sales engineer of a company supplying steel has afterward prevailed upon the architect and owner to allow a substitute design. The latter is shaved down to the lowest limit, involving high stress in steel, short laps for bond, and defective continuity. While the substitute design will save in the cost of steel, the per cent. saved on the cost of the entire building is usually small and will not justify the risk of the entire structure.

While recognizing the fact that methods of construction and dimensions of structures proceed partly

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*The Ohio Architect

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upon experience and the desire for economy, the writer urges that, in the case of reinforced concrete, designs should follow building codes and the report of the conservative practice as fixed by the Joint Committee on Concrete and Reinforced Concrete which has recently been adopted by the American Society of Civil Engineers and the American Society of Testing Materials.

The standard designs of some of the constructing companies are also reliable and conservative. A special mention might be given to the Kahn standards of the Trussed Concrete Steel Company, of Detroit, and those of the Corrugated Bar Company, of Buffalo, N.Y., for the dimensions of beams and girders of ordinary floors and roofs.

The codes, however, are naturally behind hand in respect to the newer forms of construction, such as the so-called "flat slab" design.

In construction with new materials the tendency is to follow forms that have been developed for old materials. Thus the first reinforced concrete buildings used the old wooden construction of girders, floor beams, and slabs between the latter.

In another line the first railway coaches were patterned after stage coaches.

Reinforced concrete, however, is monolithic and continuous, not discontinuous like the old constructions.

The flat slab designs omit girders, and floor beams. There is a continuous slab over the entire floor, and it rests upon and is monolithic with the expanded heads of the columns.

The steel is disposed in either a four-way system or a two-way system.

These constructions are usually patented. Advantages are (1) the better lighting of the room, (2) the increased head room, (3) decreased storey height, (4) more simple installation of sprinkling systems, (5) simpler form work, and (6) a construction more in keeping with the material.

The construction is generally considered more suitable for loads up to 500 pounds, and column spacing up to 24 feet than for larger loads and wider spacing. When the panel becomes rectangular instead of square, the long side should not exceed the short side more than 1-3 part.

The depth of slab should be at least 1-30 the span between column centres.

The design of the expanded head of the column needs attention. It should be stiff.

The steel is in the bottom of the slab at the centre of the panel, and passes up to the top of the slab near the quarter point of the span.

The steel that passes from one panel to another should lap well over into the next span at least 60 diameters beyond the edge of the column cap. And where both bars are counted upon as reinforcing over the column, they should keep well up in the top of the slab over the column, and run 60 diameters beyond the quarter point of the span.

The amount of steel should be about the same in the various patented arrangements for given loads and spans.

Over the column head, the amount of steel should be sufficient to resist an external bending moment equal to 1-15 WL (for interior square panel); where W equals total load, live and dead, on panel; L equals span centre of centre of column along direct line.

The British Government has appointed a Commission to proceed to Canada and Newfoundland to enquire into the possibility of opening up new sources of supply of mining timber for use in the coal mines of Great Britain.

Painting Concrete Surfaces

A PAPER by H. A. Gardner, read before the American Society for Testing Materials, presents data tending to show that pure oil paints can be used satisfactorily for painting concrete surfaces either for decoration or for damp-proofing, provided the surface is first properly primed.

Probably too much importance has been attached to the alleged destructive action of lime found upon cement surfaces. It is well known that setting Portland cement develops free lime, but the amount to be found upon a Portland cement structure should be considered as negligible in most instances, so far as it might affect a well-designed paint. If indeed it is advisable to neutralize this small amount of lime, previous to painting the cement surface, such a result is not to be properly accomplished with an organic substance, but rather with an inorganic material which readily reacts therewith. A solution of zinc sulphate has proved most efficient for this purpose, and has been used for many years with practical results, especially upon freshly laid cement.

As the result of a series of tests to determine the durability of various types of paint upon Portland cement surfaces exposed to the weather, Mr. Gardner draws the following conclusions:

Opaque white pigments, such as basic-sulphate white lead, basic-carbonate white lead, zinc oxide, and lithopone, were present in the paints which gave the best results. In some of these paints, there was also a percentage of inert pigments, such as barytes, asbestine, whiting, china clay, gypsum, and silica.

Concrete surfaces can be decorated with excellent results through the use of high-grade oil paints. When the cement surface is freshly laid and is damp, such paints may be safely applied after treating the cement with a zinc sulphate primer.

The Proposed Civic Centre at Vancouver

IN view of the open competition for competitive designs in connection with the development of the new Civic Centre at Vancouver and the extensive scheme under consideration, some details concerning the proposed buildings will be of interest.

To form the Civic Centre the following buildings will be grouped: City Hall, Public Hall and Auditorium, Public Library, Technical College, Museum and Art Gallery. It is proposed that the City Hall be erected first. In all probability the construction of the Technical College and Public Library will be undertaken soon afterwards. Next in order will be the Public Hall, to be followed by the Museum and Art Gallery. The City of Vancouver and the Provincial Government own an area of approximately eight acres which will probably form the nucleus of the scheme. Designs must be addressed to the Secretary, Vancouver Civic Centre, Board of Trade Rooms, Molson's Bank Building, Vancouver, on or before 12 o'clock noon, November 31st, 1914. The committee's award will be made not later than December 31st, 1914, after which date the designs will be exhibited in Vancouver.

General Points on Moving Large Structures*

IN preparing a building or structure of any kind for raising and moving it will be necessary to make a careful study of the structure. The weight should be carefully estimated, the general construction of the building should be understood, in order to know the distribution of loads on present foundations. The character of ground over which the structure is to be moved should be considered, especially if the building is of a heavy type.

After the above points have been carefully considered, a layout is made showing the manner of picking up the structure, which is done in the case of a brick or stone structure by inserting either beams or heavy cross timbers at proper places to take the load without causing strains in the main structure, when the building is raised. The main principle in raising structures is to keep conditions as nearly as they were, when on original foundations.

In the case of steel structures, special consideration is given to each individual case and no set method can be laid down for the work; however, the general principles are applicable to all structures.

The following sketch, Fig. 1, shows the manner of building a blocking and the setting of timbers and arrangement of screws for raising a structure. Regularity and care must be used in building the blocking and in the manner of setting the screws and locating cross-timbers for taking up the building.

After the building has been raised the required height and it is desired to move it, oak runs are built and the building lowered on rollers which bear on 6 x 8-in. oak runs below and on roller planks above, after which the jackscrews are removed. This is shown by the sketch, Fig. 2.

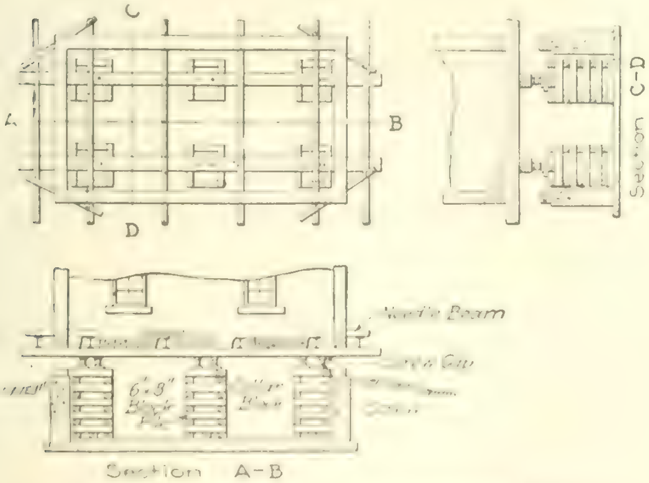

Fig. 1—Arrangement of blocking, timbers and screws for raising a building.

In case it is desired to turn the building slightly, the rollers can be "cut," that is, set at a slight angle to the general direction and gradually brought over to proper line. Cutting the rollers is a term used for knocking one end of the roller slightly with a hammer to change the general direction of the structure being moved. However, it is sometimes necessary to actually cut the rollers with a saw. Where the building is to be given a quarter or half turn, or a complete turn, a pivot point is selected and runs laid and rollers set to operate about this point (Fig. 3).

In the alteration of buildings such as the change in fronts or shoring of floors or the supporting of heavy structures where high blocking would be required, pump logs or drums are used. Pump logs are timbers, usually 8 x 8 in. in size, but often larger, one end of which is bored to a 4½-in. diameter about 18 ins. deep. In this hole operates the screw, the lower part of nut sets in the 4½-in. hole in the timber and the flange of nut bears directly on the bottom of timber—more often a collar block is used to form a bearing for the nut. Drums are usually set in position with the screw at the lower end, so that the screw may be more easily operated.

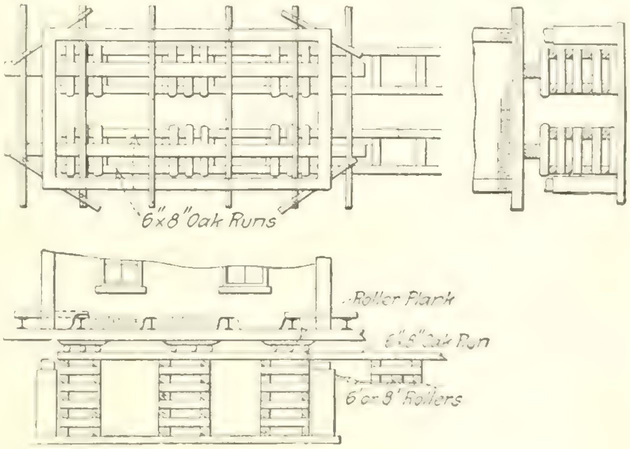

Fig. 2—Arrangement of runs and rollers for moving a building.

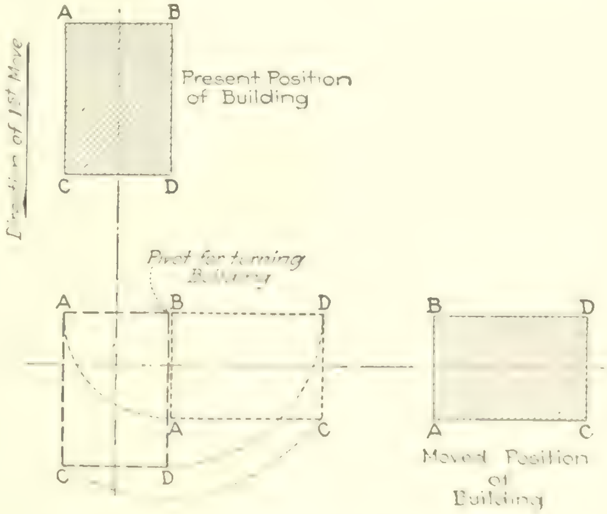
A
B
C
D
Present Position of Building
Direction of 1st Move
Pivot for turning Building
A
B
D
C
D
A
C
B
D
A
C
Moved Position of Building

Fig. 3—Plan for moving a building and making a quarter turn.

In the moving of brick structures great care is required to keep the building level and the movement uniform. It is usually customary to run cables entirely around the building and tighten by means of ratchets. In attaching the ropes to take the blocks for moving a brick structure, these are not connected directly to any part of the brick building, but to the timber or steel grillage upon which the building sets.

The building is watched carefully by all the men to assure raising in a level position. These levels are procured by means of ordinary carpenters' spirit levels, which are placed on runs and timbers which support the structures and these kept as near level as possible. In raising the building a number of screws are divided among the men. Each man may have [illegible] screws to turn. Each man takes his screws and makes two rounds on a given signal. He starts at one end and makes a quarter turn and goes through to the end of his rows, and then returns and stops until every one else is through and until the signal to turn is given again.

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* From a paper by [illegible], published in the Proceedings of the Engineers' Society of Western Pennsylvania.

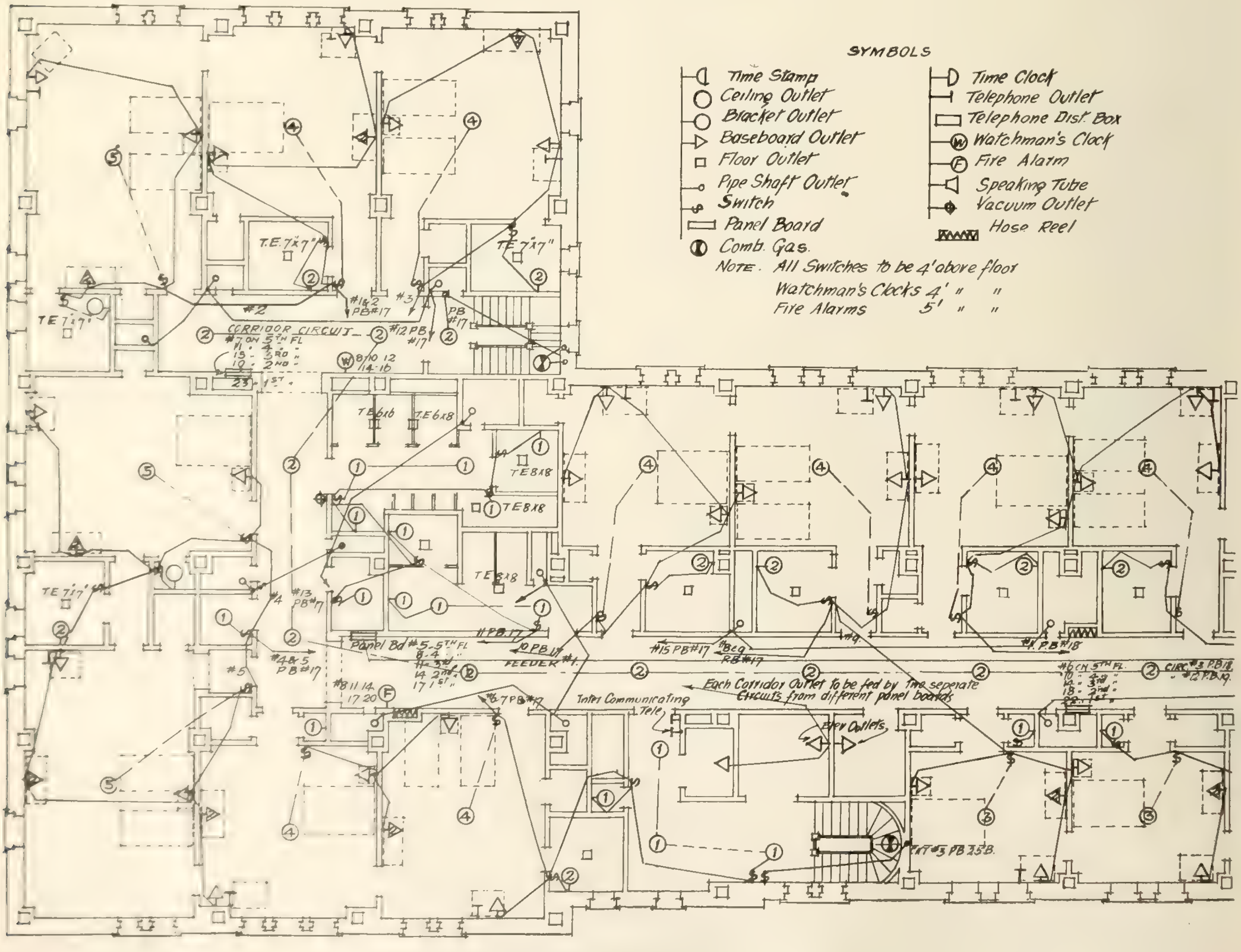
The Wiring of Large Public Buildings

NO class of building is receiving more attention at the present time as to the electrical installation than our large hotels. An excellent example of this is the Hotel Macdonald, Edmonton, one of the chain of fine hostelries the Grand Trunk Pacific Railway Company are installing across Canada. This hotel, in common with the Fort Garry at Winnipeg and the Chateau Laurier at Ottawa boasts as complete an electrical installation as can be found anywhere on the continent. The architects of the building, now nearing completion, are Messrs. Ross & Macdonald, Montreal; the general contractors are the Canadian Stewart Company, Montreal. The electrical equipment is being installed by the L. K. Comstock Company.

In accordance with the best practice no wall lights have been installed. These have long proved unsatisfactory both on account of the fact that they generally render a re-arrangement of the furniture impossible and also because they do not provide a general illumination. Prejudice in their favor, on account of their decorative effect, has died hard, however, and it is only within the last couple of years that the comparative uselessness of wall lights as a means of illuminating a room has been recognized.

The Hotel Macdonald is following the most approved practice and installing a centre ceiling outlet in each room with at least three baseboard outlets. This means one base outlet for a wiring desk, one for the dresser and one for a reading lamp beside each bed. These baseboard receptacles also facilitate the use of all sorts of modern electrical appliances such as curling tongs, electric irons, small electric heaters, etc., all of which add to the comfort and convenience of the guests. Further, each room is equipped with two circuits so that in case of trouble on one circuit the guest is not placed at the inconvenience of being without illumination. Each bedroom floor is supplied from three panel boards which lead direct from the main switchboard thereby insuring a portion of the general illumination in each floor under any emergency except an entire break-down of the generating plant in the basement and at the same time of the local municipal lighting system.

The laundry and culinary department are equipped with the latest modern electrically operated apparatus. Electric elevators are installed and a complete electrically-driven ventilating system. The laundry machinery is, of course, of the most recent design and the units are driven, wherever possible, by individual motors.



Part of a typical floor plan of Hotel Macdonald, Edmonton, Alta.

The lighting is supplied from a 110/220 volt, three-wire, direct-current system. Power is supplied at 250 volts direct-current.

The hotel is supplied with its own generating plant consisting of Goldie & McCulloch engines and Triumph Electric Company (Cincinnati) generators. In addition to the private plant the lines of the Edmonton municipal plant have been extended into the hotel as insurance against break-down in the private plant.

The wiring is in conduit throughout, the material being supplied by the Conduits Company, Limited.

In addition to the features already mentioned a number of floor outlets have been installed; also a time clock system, a telephone system, a fire alarm system, and a vacuum cleaning system. We reproduce herewith a portion of a typical floor plan. The portion reproduced represents perhaps one-quarter of one of the five floors.

Reporting on Public Service Properties

By E. P. Roberts*

THE engineer has many opportunities to benefit mankind; by research work, assisting younger engineers, and endeavoring to assist in advancement of all kinds—civic, industrial, sociological—along many of which lines his training makes him especially useful. The following paper deals only with his employment by Capital to obtain returns for Capital, and, therefore, values are financial values. The engineer is paid in cash to deliver in cash.

Employment of Engineer on Financial Basis

Engineers often complain that their compensation is not proportionate to their ability and responsibility. After-dinner speakers especially dwell on such points. But engineers are not unique in this respect. From ministers, lawyers, doctors, architects, bankers, manufacturers' associations, trade associations, and other groups, the same complaint is heard: "If it were not for us, where would be our civilization? We are the great benefactors of the human race; pay us what we consider is in accordance with the benefit we confer." In a general and broad way, everyone receives for his services in proportion to supply and demand. To such extent as the measure of compensation is financial, each person receives an amount of money based on what the buyer believes he must spend to obtain that which he desires. When Capital employs an engineer, it is on the basis of financial benefit to Capital, and the engineer accepts employment on such basis. If the engineer does not furnish to Capital the best advice obtainable he is as dishonest as if he does not make every effort to obtain full value from a contractor whose work he supervises. It is the engineer's duty to study each and every question, which either directly or indirectly affects such portion of the problem as is in the engineer's charge, and then to advise the representative of Capital to the best of his ability. If personally he is not able to advise competently, he should obtain such advice and pay for it, or inform his superior officer, or client, that certain questions, or certain phases of some one question, should receive greater attention and investigation than his knowledge or available time will permit. Many engineers have had no training in financial matters, but it is becoming more and more realized that the engineer should have a broad training, including a knowledge of the principles of economics, accountancy, and business law, and should be able to study engineering problems with relation to financial results. There has, possibly, been a feeling that information along financial lines was difficult to obtain, or so intricate, or unscientific in character, that the engineer could not expect, by the expenditure of such effort as practicable, to obtain any knowledge which would be helpful. The engineer appreciates the fact that he must obtain a broad and general engineering knowledge before specializing, and then must specialize before he can make exceptional progress in any line, and concludes that there is no time available in which to obtain knowledge along other lines, or there is no necessity for it, or both. Whatever the reason for such conclusions, it is erroneous and harmful to him and to the profession. If representatives of the legal and engineering professions in any one city are compared, it will be found that more lawyers than engineers are consulted on financial questions. Lawyers receive a broad general training, as do engineers, and then usually specialize. There are always a number of prominent lawyers who are directors in banks, and others are appointed receivers for bankrupt properties. Of course, such receivers are frequently appointed by their professional brethren—in other words, by judges. Frequently, if not usually, executive ability is more important than legal ability; in fact, frequently, legal questions do not represent ten per cent. of the problem. Without reference, however, to appointment by the Court (acquaintanceship or professional courtesy), probably the average business man would select a lawyer rather than an engineer for such a position, even when the business is a manufacturing or transportation one.

Engineers as Railroad Executives

That frequently engineers are good executives is evidenced by the growing tendency on the part of steam railroads to appoint executives from the engineering force. This is especially interesting in view of the increasing difficulties confronting railroad executives at the present time, as the result of regulation by the Interstate Commerce and Public Service Commissions. In other words, now that the business must be conducted on a basis, Wall-street methods, or those frequently considered as such, are no longer permissible.

Comprehensive Advice

I have already stated that the engineer should have one aim—namely, to obtain dividends for capital; but if he is only able to advise as to the technical design and construction cost, it is evident that his usefulness, and therefore the value of his advice, is exceedingly limited. He may be able properly to advise correctly as to the financial results as between two different classes of structure. An example of such simple character arises when considering the comparative advisability of building a trestle structure or a comparatively permanent bridge. He may be able to report as to the first cost, and proper allowance for maintenance and depreciation of each, and possibly correctly state that, for the case under consideration, the cheaper structure is the preferable one, if considered on the direct basis of cost per year, including interest, maintenance, and depreciation; or that from the standpoint of fire or floods, it may not be advisable. He may properly consider the funds available and financial demands at other points, and state that the erection of a permanent and expensive structure can wisely be left to the future. The above example is a comparatively simple one, though frequently such simple cases are not sufficiently investigated by the engineer. The engineer cannot expect to become an expert lawyer, accountant, economist, or financier; at least, most of us would not be so optimistic. He should, however, appreciate and understand the result of the investigation made by experts along such lines, and the application of such results to the work of the engineer.

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*From a paper read before the Engineers' Club of Philadelphia.

Co-operation

The engineer should also appreciate the fact that it is part of the duty of the engineer to inform other experts as to many facts which often they would not know existed unless he calls the same to their attention, and, in addition, there are many factors the full value and effect of which cannot be ascertained except by co-operative effort. Even in purely technical work the engineer must rely upon others. If he is in charge he should understand the general principles of the methods followed by his assistants, in order to appreciate the value of the result obtained by them, and to take full advantage of their abilities. For example, many of us are no longer able to work out problems in higher mathematics; but if we did not know what could be best accomplished by the application of same, or understand the meaning and comparative value of the answer submitted, we would not instruct someone to make the investigation or calculation; in fact, we might not have such a man in our employ, because we would not feel the need or appreciate his usefulness. To obtain the answer to a technical example is important: that is what we pay the assistant to do. To ascertain the value of the answer and place it in the proper place with relation to all the other factors of the main problem, is what our employer pays us to do.

Technical School Training

In the past few years more and more attention has been given in technical schools to instructing the students in the fundamental principles of accounting, business procedure, and business law. A leader in such work is Dr. A. C. Humphrey, now President of the Stevens Institute of Technology. He, by virtue of his business, in addition to technical training, realized the importance of starting the students along the lines above mentioned, in order that they might, to as great a degree as practicable, not only understand the general principles, but, of more importance, appreciate their bearings upon and relation to the technical work of the engineer. Lectures and examinations on such subjects have been for many years part of the regular work at Stevens. Recently a conference was held at Stevens upon "The Engineer's Part in the Regulation of Public Utilities." The conference was attended not only by alumni and guests, but also by the under graduates. It was addressed by a number of prominent corporation officials and by a member of a public service commission. It seems to me that many of those present, though especially the students, will become bigger men and more competent and fully-rounded-out engineers, because of the conference; not so much on account of the information conveyed, valuable as it was, but because of the inspiration resulting from hearing such subjects discussed under conditions especially tending to influence young men.

First.—What is a Public Service or Public Utility Property?

Second.—Why is it constructed?

Evidently the answer to the first question is that a public service property is one constructed to give service to the public. The service may be rendered by the community—municipal ownership—but such is not the ownership of the properties now to be considered, though the same general principles should be applied, including engineering, operation, and accountancy. A public service property is usually considered as one furnishing service to the public, but the ownership of which is private. The peculiar characteristic features are that the owners agree to give adequate service, and the public agrees to give the owners the opportunity to furnish the service. Certain privileges are granted, such as condemnation of properties for right of way, rights in the streets, etc. Frequently, not always, the public permits, or practically assures, a monopoly, either during "good behaviour" or for a specified period. The person who serves is a servant—at least, according to the dictionary; but in fact the duties of the servant are liable to be forgotten. The person served is the employer or "boss." Sometimes the latter term not only seems more personal, but also more applicable. Commissioner C. J. Prouty, of the Interstate Commerce Commission, in an address to the Cleveland Chamber of Commerce, stated: "Now, to go back to my proposition that the railroad is the servant of the public. Assume that you had an intelligent servant, who was especially skilled to do a particular thing, how would you, as a prudent master, treat that servant? You would certainly give him enough to live on, because he couldn't work until he could properly subsist." Mr. Prouty also stated, referring to the railroads, that the servant was at one time the master, and, if I correctly understand his statement, that there is now a tendency to starve the servant and to take away both incentive and ability to give adequate service.

Another way of considering the relationship is that of a special partnership agreement between the public and the public service corporation.

Franchise Period

Franchises may be short term, perpetual, or indeterminate. Short-term franchises have many defects, perpetual franchises frequently, possibly inherently, do not properly protect the public, or the owner, or both: they are either "wide open" or have unwise restrictions. Indeterminate franchises, sometimes termed indeterminate permits, are permits to control and operate during "good behaviour" on the part of the corporation legally supposed to be "enjoying" the operation, whatever may be the facts as to such enjoyment. It is also often presumed that the owner will be protected from competition because it is in the interest of the public that the utility be a "monopoly," and that if the owner exercises reasonable care in designing, constructing, and operating the utility, that he will be permitted to obtain and retail such form of enjoyment as results from dividends. To an increasing degree it is becoming a fact that public service commissions are not only protecting the public, but also are —or, at least, some are—protecting the owners and instructing the public as to not only what is fair treatment, but also what is in the permanent interest of the public.

In the issue of January, 1911, of the American

Academy of Political and Social Science (Electric Railway issue), the statement is made that the Wisconsin theory is that the franchise is a privilege conferred by the State, and not a contract between the municipality and the company, and that it is subject to State regulation when and as regulation is required. Massachusetts permits a certain "location," and other States have different angles of approach; but, I believe, that the general tendency is towards control and protection. Control, as to financial scheme and securities issued and as to service; protection, as to avoidance of all forms of special tax, for which the public, or, rather, the users, must pay or not obtain adequate service and protection from competition. An indeterminate franchise is somewhat similar to an indeterminate sentence, as it is also dependent upon "good behaviour." Both indeterminate franchises and indeterminate sentences have good features, though the particular recipient may not always appreciate the application.

The second question is, "Why is a public service property constructed?"

The answer might seem to be because of the public need. The correct answer is because someone thought it would pay him. It is the same reason which exists for putting forth any effort. The question always asked is, "Will it be profitable?" In a business transaction the profit is measured in money. There must be a promoter, and this promoter is a most helpful member of the community, though not always for it.

Why is an engineer employed to report on a public service property? Usually in order to inform his client as to whether the property has paid, or will pay, or both, on the investment. The engineer must, or should, be a skilled prophet.

The author then went on to consider the preparation of a report upon a proposed interurban electric railroad, touching briefly upon some special features of reports relative to existing properties and properties other than interurban railroads.

Mr. J. G. Koppel, Superintendent of Bridges at Sault Ste. Marie, Ont., describes in "Railway and Locomotive Engineering," a clever bridge repair, which may be found noteworthy in connection with other structures. A crack developed in the foundation of the bridge crossing the ship canal at Soo, Ontario, as shown, which amounted to fifteen-sixteenths of an inch. A ½-in. steel plate was made in three sections, and drilled to fit on the jack-shoe bolts, and one jack-shoe at a time was removed and the plate laid in place and the jack-shoe replaced. When both plates were secured in position, then the centre-plate was put in and the bolts screwed down, and when all were in tension the masonry was drawn into its original position, while a mixture of cement was poured into the crack, which made a very good job, as the foundation is now apparently as good as could be desired, and safer than the original structure, as nothing short of an earthquake could move the steel plate that was added to the structure. Not only so, but it is evident at a glance that a new idea has been added to structures of this kind. Masonry under direct vertical pressure is always reliable, but under slightly horizontal pressure of an intermittent kind, such as is caused by the oscillation of a heavy locomotive and attached train rounding a curve, the tendency of the masonry to crack or dislocate is very great, and a reinforcing plate should be used.

Canada's Trade With Germany

In view of the fact that Canada is absolutely prohibited from trading with Germany, the following comparative returns are interesting:

Fiscal Years	Imports—(Merchandise) Total	Exports—(Merchandise) Total	Totals Imports and Exports
1894	$ 5,872,085	$2,046,052	$ 7,918,137
1895	4,983,369	626,976	5,610,345
1896	6,454,705	757,531	7,212,236
1897	5,785,546	1,045,432	6,830,978
1898	5,763,784	1,837,448	7,601,232
1899	7,381,149	2,219,569	9,602,068
1900	8,706,641	1,715,903	10,422,544
1901	6,677,959	2,141,552	8,820,816
1902	10,919,994	2,692,578	13,612,572
1903	12,127,867	2,097,699	14,225,566
1904	8,028,544	1,819,223	9,847,767
1905	6,642,095	1,146,654	7,788,793
1906	7,040,091	1,872,557	8,912,648
1907 (9 months) ...	5,483,207	1,066,605	6,549,812
1908	8,250,745	2,374,607	10,625,352
1909	6,001,406	1,476,552	7,478,006
1910	7,958,264	2,501,191	10,459,455
1911	10,087,199	2,663,017	12,750,216
1912	11,146,739	3,814,914	14,961,660
1913	14,473,833	3,402,394	17,876,227

IT is refreshing to learn from Mr. W. N. Ashplant, City Engineer of London, Ont., that the European war has not materially affected municipal projects in the Forest City. Work is proceeding as usual on various local improvements, and upwards of four hundred men are employed on the construction of storm and sanitary sewers, pavements and cement walks. It is the intention of the city, we are told, to continue constructional operations as long as weather permits. Of course it must not be taken that there is an abundance of work at London and that this city is a sure haven for all the unemployed, but conditions generally, so far as the local situation is concerned, are very satisfactory. The municipal programme now being carried out comprises sanitary sewers, cement, brick, asphalt and reinforced concrete pavements, and the various storm sewer contracts undertaken early in the season.

A new method of destroying teredos, a pest which has caused enormous damage in the destruction of piles used in wharfage construction in north Pacific coast ports, particularly in Vancouver, Seattle and Tacoma, by turning an electric current into the piles, is being tried in Seattle. These pests have so far successfully defied all attempts to eradicate them from the timbers supporting the various structures along the water front in the Puget Sound and British Columbia ports, and a means of destroying them will prove a great saving to individuals and companies maintaining docks and wharfage properties on the coast.

An increasing share of the rapidly growing consumption of cement in the United States is being supplied by the domestic industry, production having risen from 8,000,000 barrels in 1890 to [illegible] in 1913; while imports of cement have fallen from 2,350,000 barrels in 1890 to 95,827 barrels in the fiscal year 1914, with one exception the lowest total reported in many years.

The Cost of Doing Business, as a Factor in Contract Work

By Edwin L. Seabrook

WHAT does it cost to do business? This is a vital question to every one engaged in a competitive line, such as building construction. Vital as it always has been and is, it is understood by some, applied by a few, misunderstood and misapplied by many and unheeded by many more. It is vital because upon its proper application depends the profits to be derived from the business.

Every price asked for a piece of work is or should be composed of four items: cost of material; cost of labor; expense of conducting the business; profit.

It is impossible to perform any contract, however small, without the first three of the above items entering into the price asked. It is possible and many do get along without the last item—profit. This is not intentional, but because the third item—expense—is not properly understood and applied. If the item of expense is not known how is it possible to intelligently estimate and compile a price for doing work? Many wonder at the end of the year where the profits are they believed were being made during the twelve previous months.

The difference between forty cents an hour paid to a mechanic and the sixty cents received for that hour's time on jobbing looks like a big margin of profit and many are deceived by it because the expense of carrying on the business one hour is not accurately understood. When the microscope of cost analysis is put on this twenty cents very little of it will show as profit.

During the hour the mechanic worked a very large percentage of this twenty cents was sent out in many directions for many items of expense; when the expense for the hour is taken out very little is left of it. No doubt many will look askance at the statement that, unless the employer charges fifty per cent. more per hour than is paid mechanics when hiring them to some one else by the hour, he is hardly breaking even. This is a fact, nevertheless, in some lines of building work and can be clearly demonstrated. Whether the fifty per cent. is too little or too much in some lines of building work, the principle will maintain.

The cost of conducting business is more often underestimated than over-rated. Many are willing to delude themselves with the plea that they are not under as much expense as some other competitor; in only exceptional cases is this true. One man thinks because he works himself, does his bookkeeping (what is done) at home nights, he cannot possibly have as much expense as the competitor doing no mechanical work himself and employing office help. This theory may be correct, but it cannot be worked out in practice. No employer can himself do mechanical work all the time, and unless he does, this beautiful calculation is upset; at least one-third of his time will be spent in looking after work, collecting and many other things of like nature. His expense goes on while he is attending to these duties, but he is not producing anything to meet it.

An analysis will show that the cost of conducting business is just about the same for each one in any particular place in the same line of business. One may have an advantage over some one else, but this is nearly always offset by some disadvantage generally overlooked in making the comparison. Cheap rent for one may be offset by undesirable location, increased expense in handling work, holding trade, or securing a proper share of the natural increase in business. Personal interviews with hundreds of firms in one line of the building business on this very question of a level expense rate of conducting business in the same city confirms the statement that no one firm has any advantage over another.

Some of the items that enter into the cost of doing business are: rent; interest on investment; light and heat; insurance: fire and liability; taxes, depreciation of tools, plant, etc.; horse and wagon; office help; advertising; telephone; printing; postage; bad accounts; salary of proprietor.

Every one of these items must come out of the price received for work. If these items are not put into the price in the form of expense it is not possible to get them out unless the fourth item—profit—composing the price is robbed. The cost of the above goes on Sundays, holidays, nights, rainy days, through dull times; it stares one in the face three hundred and sixty-five days in the year. Any one keeping an account of cash expended can readily ascertain the amount of the different items entering into the cost of doing business. Many do not do this and their case is hopeless; others do not keep an accurate cash account and thus pay out sums for expense which are never included in any attempt to ascertain the cost; others are not over particular to include every item. One person told the writer when he named many small items not included in his schedule of expense: "Don't get the thing down too fine." Too many are afraid of this measuring rod. One important item is often overlooked; that is, interest on the amount of money invested. This item should come in the expense account, because if the money was not invested in the business it could be loaned and bring a fair return. The same principle will apply to buildings owned by the proprietor who thinks a proper rental should not be included in the expense account.

Disbursements of money in any form of contract business can generally be classified under three heads. Material, productive labor, and expense. By productive labor is meant mechanics who actually produce something for which a price can be charged. A driver or a clerk would not come under the head of "Productive Labor." Any payment of money, therefore, that cannot be charged to productive labor or material is and must be a part of the expense of doing business. This simple classification of expenditures may assist many who wish to ascertain what it is costing them to do business.

Assuming that a fairly accurate schedule of expense has been made, what about the application? This is more important than may seem at the first glance.

There are two methods, both of which have been widely discussed within the last three years. One is to add the cost of labor and material for the previous year and find the percentage of expense on this total.

The other is to make the productive pay roll, or, in other words, time, bear the entire burden of expense. The first named method seems to be (although mistakenly) the easiest understood and applied and is the most frequently used. Like many other easy things it is often misleading and subject to fluctuation. It often allows the user to ease his conscience when in a tight place by not insisting upon it being applied in full. Those who honestly use this method are on much safer ground than those who make a guess at the expense and get about half enough. The second method is somewhat newer, not quite so well understood, but is just as easy of application as the first, and is much safer because it lays a plumb line on every item of work done, is more accurate, more uniform and does not allow loopholes through which to crawl by knocking off part of the percentage which should be added to high priced materials with the plea that the job will not stand it.

Application of Cost

Shall the expense of conducting business be applied by the percentage method on the cost of labor and material combined or on productive labor alone? This is important because it does affect very materially the price named in some cases. The latter method makes the time it takes to do the work bear the entire expense. There is a vast difference between material and time regarding expense. The only expense incurred by material is the interest on the money invested in it. Expense is measured by time and goes on every day in the year, whether holiday, weather conditions permit of working, or in lost time, etc. Rent and a hundred other items are not measured by the cost of material, but by time. The whole expense is so much for a year, a month, a day, down to so much an hour. A man renting space in a garage pays for the time occupied regardless of the cost of the machine. Time measures the expense of doing business and this should be applied on the time it takes to produce the given piece of work regardless of the cost of material. Ten pounds of iron may be worked into an article in an hour; but it may take three hours to make another ten pounds of iron into something else. The latter should bear three times as much expense as the first. Ten pounds of copper may be worked up by the tinner in the same time as ten pounds of iron; while one costs six times as much as the other the same amount of expense should be applied to each. Simply because the copper as material cost more than the iron, in the working it did not consume any more rent and other expense. It is therefore most unjust to make it bear several times more expense than the iron, which would be the case if applied on a percentage basis of material and labor.

One simple illustration will show how easy it is to disregard the cost of doing business and almost toss it aside entirely when it is applied on the cost of labo and material. Let us assume a bid is asked on some work and the estimator allows twenty per cent. of the cost of labor and material for expense. The material costs $100; labor, $25, or $125; 20 per cent. for expense is $25, making a total of $150, upon which can be added the desired profit.

Suppose the one for whom the work is to be done wishes the material changed to a much more expensive one; something that will cost, say, six times as much. It will take a little more labor for this expensive material, but for the illustration let it remain the same. The estimate then would be: Material, $600; labor, $25, or $625; 20 per cent. for expense, $125. Total, $750. Note that the expense item has jumped from $25 to $125 by simply changing the material. Does any one pretend to say that the "expense" of doing this work increased $100 simply because of the increased cost of the material? How many would say: "If I add that amount for expense I will get the work." If the amount is not added there is a certain loss because the percentage of expense is based partly on the price of material. The expense calculation at the beginning of the year showed that 20 per cent. must be added to the cost of labor and material in order to meet this item. If $50 or $75 of this particular $100 is disregarded who can say that this is not a loss? True, the loss may not be realized, but the expense must come from somewhere. If a sufficient amount is not in that column it must come from the profit column. If the expense item had been placed entirely upon the time it took to perform the work the price for the more expensive material would have been more reasonable.

Perhaps the wide difference in some estimates is not due so much, as is often intimated, to ignorance or error, as the proper application of the expense item.

How shall the expense be applied to time alone? It is the simplest of all methods. Take the wages paid mechanics or productive pay roll; take every item of expense and compare the two; get the percentage of expense to pay roll; if the pay roll to mechanics that produce is $5,000 a year and the expense is $2,500 then the expense is 50 per cent. of the productive pay roll. When a dollar is spent in wages, fifty cents has gone in many directions for expense. Let no one deceive himself about 50 per cent. being too high a percentage for many lines of building work. Experience from more than nine-tenths of the tests made by comparing a pay roll book and the expense account shows that it is around 50 per cent., varying but little one way or the other. If this be a fact can the employer pay a mechanic forty cents an hour, hire him to some one else for fifty-five cents and make a profit?—National Builder.

At Hamilton, Ont., the principal work now under way is the West End sewage disposal plant, which will be completed during the next five or six weeks at a cost of $70,000. The main pumping station at the Beach will be finished in a couple of months. These works, with the asphalt paving construction, will maintain the activities of the Engineering Department for the remainder of the season. It is intended to ask the provincial government for authority to proceed with the installation of a trunk sewerage system in the eastern portion of the city at an estimated cost of $110,000.

The Nova Scotia Steel & Coal Company is reported to have received a large contract for shells for the Canadian artillery. Contracts for the production of shells are said to have been placed with all the steel plants possessing the necessary equipment for turning them out.

Manufacturers in the electrical trade on the other side of the border claim that the removal of Germany from the field, even temporarily, will result in diverting to the United States electrical orders worth $100,000,000.

Constructional Features of a Double-Deck Car Barn at Vancouver

Work is already well advanced on the construction of a car barn for the B. C. Electric Railway Company, Limited, at Vancouver, B.C., the estimated cost of the structure being [illegible]

Some years ago the company purchased an entire city block in the Mount Pleasant district with the idea of utilizing the block for car barn purposes. The block has a frontage on Main Street, one of the principal car line streets in the district, and extends to Quebec Street, the other boundary streets being Thirteenth Avenue and Fourteenth Avenue. On the north half of the block the company several years ago erected two car barns of the galvanized iron type of construction, capable of accommodating 60 cars. The new barn now in course of construction is located on the south end of this block and adjoins the old structure. The new barn will be two storeys in height on Main Street and one-storey in height on Quebec Street, the difference in grade between the two streets being such as makes this plan possible. The dimensions are about 350 feet by 130 feet, the height of each storey being approximately 20 feet. On the ground floor the entire area will be available for the housing of cars, the ten trucks making provision for 62 cars. The Quebec Street frontage of the second storey is placed 45 feet back from the street line, thus giving a floor area of 302 by 130 feet, sufficient for the accommodation of 58 cars. This will make the total capacity of the new barn 120 cars and the total capacity of the company's barns on the block, 180 cars.

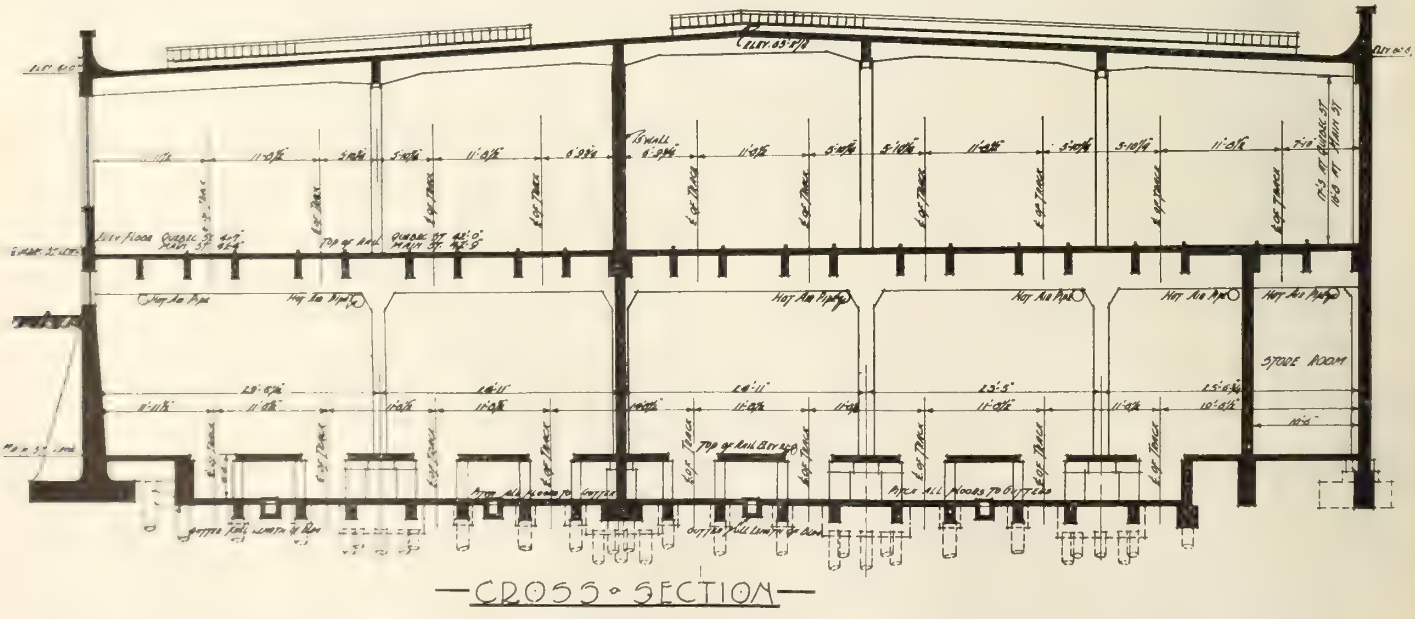
Interior new B.C.E.R. car barn.

The block is naturally low lying and after investigation of the soil the engineers decided that a pile foundation was advisable for the new barn. The average length of the piles driven is 20 feet and the building is so designed that the entire load is carried on the piles, no allowance being made for any load being carried on the soil.

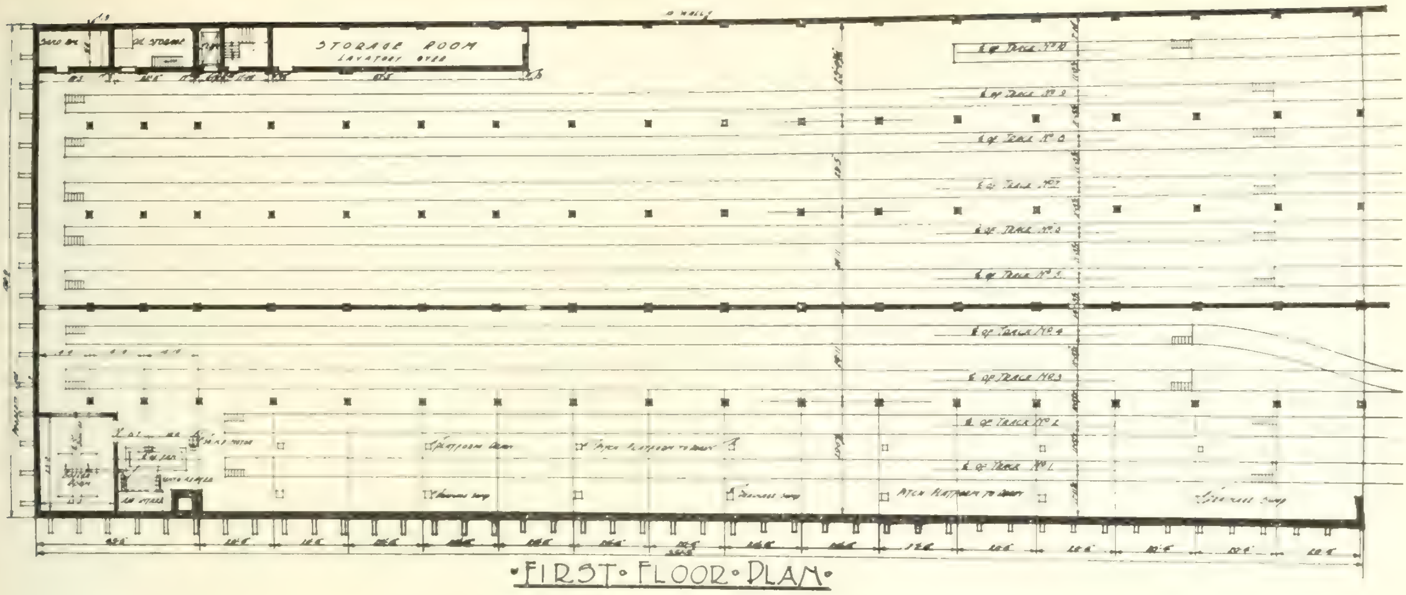
The general type of construction throughout the entire building is reinforced concrete skeleton with the exception of the columns between the first and second floors, where steel is used in order to economize floor space.

The building will be finished with 13-inch brick walls on the outside. In these walls will be fixed steel sash glazed with quarter-inch wired glass and steel doors of the rolling type which are to be chain operated. Practically all the tracks on the first floor will be provided with pits for inspection purposes. The floor consists of five-inch reinforced concrete slabs between the rails, these being supported on 12-inch square concrete piers, placed at about seven feet centres, extending from the pit floor. The pit floor is 4½ feet below the level of the barn floor and is formed of six-inch concrete with piles under each of the track pedestals and building columns. The floor is graded to drain into four channels 10 inches wide which run the whole length of the building and are covered with iron gratings.

The second floor will be used merely for storage purposes, no provision being made for inspection pits, etc. Five-inch reinforced concrete slab construction is used with reinforced concrete girders 8 by 24 ins. placed under the rails. The second storey is supported on concrete covered steel columns placed between each pair of tracks, the centres varying from 23 feet 5 inches to 29 feet 6¼ inches and the lengthwise spacing being about 20 feet 4 inches. The cross girders be-



Cross section B.C.E.R. Company's new car barn, Vancouver, B.C.



First floor plan B. C. E. R. Company's new car barn, Vancouver, B.C.

tween the columns are 3 feet 10 inches in depth. The roof of the building will be 3½-inch reinforced concrete slab carried on cross concrete beams 18 inches in depth.

For the construction of the building it was necessary to excavate about 12,000 cubic feet of earth. The approximate amount of concrete used is 5,500 yards and the construction plans call for the use of about 400 tons of steel.

The building will be heated by an indirect heating system, oil fuel being used. This installation consists of two 70 h.p. boilers, the heating being driven through ducts running through the building, by a 130-inch fan. For the rooms set apart for the use of barn employees and street car men a direct steam heating system will be employed.

In accordance with the requirements of the fire underwriters a steel tower carrying a water tank with a capacity of 35,000 gallons will be installed above the second storey. This is connected with a sprinkler system which provides 2,450 heads throughout the building, both roof and aisle sprinklers being installed. Both floors are divided into two sections by a thirteen-inch brick fire wall.

One track on each floor will be arranged for the washing and painting of cars. On the lower floor provision is made for a room for sand drying and the storage of oil. On this floor is also located a shop for carrying out minor repair jobs, a freight elevator 5 by 8 feet in size connecting the shop with the second floor.

The cars will enter the first floor of the barn direct from Main Street. For the purpose of affording entrance to the second floor the company will construct a track from Main Street along Thirteenth Avenue and Quebec Street to the second storey entrance. The plans of the company provide for the continuation of the facade of the new barn along the entire Quebec Street frontage of the block.

It is expected that a portion of the accommodation afforded by the barns will be available [illegible]

The new barn is designed to accommodate the cars of the company operating in the eastern section of Vancouver as well as its South Vancouver lines. For the accommodation of its cars operating in the western section of the city the company last year constructed a large car barn in the Kitsilano district.

Operations are progressing satisfactorily on the erection of the [illegible] Apartments at Toronto. The estimated cost of the new building is $500,000. The construction is steel, stucco and brick, and the building will be eight storeys high. Messrs. Deeth & Son are the owners and general contractors, and Mr. N. G. Beggs, Toronto, is the architect.

From Winnipeg comes the announcement by Hon. Dr. Montague, Minister of Public Works, that work on the Provincial Parliament Buildings will be undertaken immediately. Constructional operations on the new law courts at Winnipeg are to be continued as long as weather permits.

A plan for the water-works system for West Vancouver, submitted by Mr. H. L. McPherson, has received the approval of the Municipal Council, and in all probability a bylaw will be submitted to the ratepayers. The estimated outlay is $150,000.

The C. P. R. Pitt River bridge in British Columbia, which has been built at a cost of $1,000,000, is nearing completion. The contractors for the sub-structure were the Foundation Company, and for the superstructure the Dominion Bridge Company. The sub-structural work was described at length in the Contract Record of September 30.

At a meeting of the directors of the Dominion Steel Corporation the President, Mr. J. H. Plummer, expressed regret that the demand had fallen off just when the plant had attained its high point of efficiency, both as regards production and quantity. He said, however, that the Company were not losing any time in getting after new business. The war had diverted quite a number of contracts to the plant. England had already placed orders for 2,000 tons of rails and 2,000 tons of wire rods, and negotiations were pending in another direction for a large order of rails.

It is announced that work on the harbor development at Toronto, will be continued in accordance with the plans laid out at the beginning of the season, despite the conditions in Europe. The Harbor Commission, of which Mr. Alex. C. Lewis is secretary, will expend approximately $1,400,000 this year on reclamation work, pile driving, piers and the excavation of the ship canal in Ashbridge's Bay. About 1000 men are now employed, half of them being in the service of contractors, and the remainder in the employ of the Harbor Board.

Personal Mention

Dr. W. A. Parks, Director Royal Ontario Museum of Palaeontology

MANY readers of the Contract Record and Engineering Review will be familiar with the Report on the Building and Ornamental Stones of Canada issued recently by the Department of Mines of the Dominion Government. The author of this valuable work is Dr. W. A. Parks, Director of the Royal Ontario Museum of Palaeontology, and Associate Professor of Geology, University of Toronto.

William Arthur Parks was born at Hamilton in 1868 and entered the University of Toronto at the age of twenty. Four years later he graduated with first-class honors and was awarded the Cawthorne Medal in Natural Sciences. Upon leaving the University he accepted a post as chemist with the Canadian Copper Company, of Sudbury, Ont., and Cleveland, Ohio. In the following year he was appointed Fellow in Geology at the University of Toronto. During the summers of 1897-8-9 he was employed as a geologist by the Bureau of Mines of the Province of Ontario and prepared a number of valuable reports. Dr. Parks has the distinction of having been virtually the discoverer of the Porcupine gold fields. In 1900 the University of Toronto conferred upon him the degree of Doctor of Philosophy, his thesis for the degree being "The Huronian of the Moose River Valley."

Dr. Parks.

In 1898 Dr. Parks was appointed Lecturer in Geology at the University of Toronto, and in 1904 he became Associate Professor of Geology. From 1900 to 1905, during the summer seasons, he carried on important geological investigations for the Dominion Government. The work for which he is best known, perhaps, was undertaken by him in 1910 and has been continued to date. We refer to his Monograph on the Building and Ornamental Stones of Canada. So far, in this connection, the investigations have covered New Brunswick, Nova Scotia, Prince Edward Island, Quebec, Ontario and Manitoba.

Dr. Parks was appointed Director of the Royal Ontario Museum of Palaeontology only last year. He is essentially the man for the work, having had exceptional opportunities of becoming an all-round geologist. Up to 1904 his work lay chiefly in mineralogy and in Pre-Cambrian and Economic Geology. Since that time, in accordance with the wish of the University authorities, he has devoted his time more particularly to palaeontology, stratigraphical and economic geology. In addition to numerous official reports, a number of papers on scientific subjects, notably a series of researches on the Stromatoporoids of America, are the results of his investigations.

Reverting to Dr. Parks' report on Canada's Building and Ornamental Stones, it is of interest to recall that he was engaged for this work by the Mines Branch in April, 1910, when it was planned to devote a large volume of the series to a particular province or group of provinces. The results of the first summer's field work in Ontario are embodied in the Mines Branch report No. 100, entitled, "The Building and Ornamental Stones of Canada, Vol. 1." The first part of this volume contains general information with regard to the quarrying, testing and handling of stone. Part 2 is devoted to a systematic description of the various building and ornamental stones in that part of Ontario which lies south of the Ottawa and French rivers. The usefulness and high standard of this monograph are attested by the fact that there have been nearly four thousand requests for copies of it since October, 1912, when it was issued, as well as by scores of complimentary letters from the highest authorities and from men prominent in the quarry industry in Canada and the United States.

Early in 1911 Dr. Parks agreed to prepare a second volume on the Building and Ornamental Stones of the Maritime Provinces. The summer of 1911 was spent in field work and sixty quarries were visited. An edition of four thousand copies has recently been published as Report No. 203 of the Mines Branch. The third portion of the work is still in the press, although a brief synopsis of it is contained in the Mines Branch Summary Report for 1912. It will consist of an exhaustive description of the limestones, sandstones, granite, marble, slate, and other building and decorative materials of the Province of Quebec. This last summer the field work has been completed on the stones of Manitoba, preparatory to the publication of Vol. IV., which will include Manitoba, Saskatchewan and Alberta.

As evidence of the esteem in which Dr. Parks is held, it may be in order, perhaps, to publish statements made for the Contract Record and Engineering Review by President Falconer, of the University of Toronto, and Sir Edmund Walker:

> President Falconer.—"By his ability and constant work Dr. Parks has earned an enviable reputation in palaeontology, and as he is still a young man he should have many years before him in which to add greatly to the good results that he has already accomplished. Recently his work on the building stones of Canada has attracted considerable attention. We regard him as a Canadian scientist of high promise."
>
> Sir Edmund Walker.—"The fact that Dr. Parks is the Director of the Royal Ontario Museum of Palaeontology is evidence of the opinion held of him as to his acquirements in palaeontology and stratigraphy. On the latter subject he is one of the best informed men in Canada, especially regarding the economic side of his subject in connection with our building stones. He has an enormous capacity for hard work and his papers on palaeontology already rank among the best productions of their kind."

Like most other men of achievement, Dr. Parks is a very modest man and the statements of President Falconer and Sir Edmund Walker were obtained by us in the ordinary round of journalistic enterprise.

In closing, it may be added that Dr. Parks is a Fellow of the Geological Society of America and a member of the Canadian Mining Institute. As a member of the Executive

Council of the 12th International Geological Congress, he has prepared a number of valuable guide books.

W. Chase Thomson has been elected to membership in the American Society of Civil Engineers.

Mr. E. J. Smith (Lumsden Building, Toronto) has been appointed Clerk of Works on the new Registry Office now under construction at Toronto. The appointment was made by the Board of Control on the recommendation of the Property Commissioner. The salary is $150 a month.

Mr. D. E. Lloyd Davies has been appointed City Engineer of Cape Town at a salary of £2,000 per annum. Mr. Davies, who resigns the City Engineership of Alexandria to take the new position, was formerly Assistant City Engineer of Birmingham, Eng. He has a world-wide reputation as a consulting engineer, particularly in regard to drainage and sewage disposal schemes.

Mr. E. L. Horwood, of Ottawa, has been appointed Chief Architect of the Department of Public Works and has already assumed his new duties. The appointment is made to fill the vacancy caused by the retirement of Mr. David Ewart, who now becomes consulting architect, after filling the major office for some forty years. The post is an important one, since it embraces the responsibility for the design and supervision of practically all Government buildings.

The Cedars Rapids Power Development

The structural portion of the Cedars Rapids Manufacturing and Power Company's plant at Cedars, P.Q., is nearly completed. The fourth progress report, just issued, states that at the end of August 97 per cent. of earth excavation other than stripping and trench work, and 90 per cent. of the rock excavation was done. The earth excavation in trenches and ditches and stripping seats of the bank is completed, while 94 per cent. of the rock excavation was transported and placed. Of the stone protection 50 per cent. was done, and 97 per cent. of the transporting and placing of excavated earth was finished. The power house building is complete, and work has been started on the wing dam at the north end. Three generators have been installed and are ready for operation. All the material in the tail-race has been removed, enabling the tail-race cofferdam to be dismantled.

The transformer house, sixty per cent. of which is completed, is constructed by the unit method, with the exception of the columns, which were cast in place. Practically all of the slabs which go to make up this building have been cast, and the work of assembling them is progressing rapidly. The transformer house will contain the machinery for stepping up the voltage of current for transmission to Montreal and to Messina, N.Y. The general contractors are Fraser, Brace and Company.

The contract for the proposed shipbuilding plant and dry dock, which is to be erected at North Vancouver, has been signed at Ottawa on behalf of his firm by Mr. H. Spratt, Managing Director of the Amalgamated Engineering Company, Victoria, B.C. Arrangements for the project were completed in London before the war broke out, so that there appears to be nothing to prevent the construction of the plant in the near future. The estimated expenditure is [illegible] 500,000.

The E. Laurie Company, Montreal, have been awarded, by the Council of Montreal West, P.Q., a contract for the supply and installation of an incinerator, of a capacity of 15 tons per 24 hours. The incinerator is of the Decarie type, and will be manufactured in Minneapolis, Minn.

Mainly Constructional

East and West—From Coast to Coast

A new incorporation at Toronto is that of the Toronto and Canadian Building Company. The firm will carry on a joint building and supply business.

At Hamilton, Ont., the excavation for a $1,000,000 soap factory which is to be erected by Messrs. Proctor & Gamble, Cincinnati, Ohio, is to be put in hand at once.

The city of Peterborough has received assurance from the Minister of Public Works that there will be little delay in getting the proposed new public building under construction.

The new St. Charles Hotel, at the corner of Bay and Richmond streets, Toronto, is nearing completion. The owner is Mr. J. J. O'Neil, and the architect, Mr. J. P. Hynes, of Toronto.

The City of Halifax, N.S., has just placed in service a 3½ million-gallon concrete reservoir. This reservoir will equalize the pressure and maintain the supply at the highest point in the high service district.

The exterior work on the new technical high school, now being erected at Toronto at a cost of $2,000,000, is well advanced. The architects are Messrs. Ross & Macdonald, and the general contractors Messrs. Norcross Brothers.

Nanaimo, B.C., has the matter of a Carnegie library under consideration and in all probability a by-law will be submitted to the ratepayers shortly. The Carnegie Corporation of New York have offered $50,000 towards the building.

On October 19 the ratepayers of Uxbridge, Ont., will vote on a by-law to raise $200,000 for electric railway construction. The project is a joint undertaking of the Provincial Hydro-Electric Commission and the Municipality of Uxbridge.

The new armoury whish the Dominion Government is erecting at Winnipeg at a cost of $520,000, has reached the roofing stage. The building is of steel and stone construction and is being erected by Messrs. Carter-Halls-Aldinger Company, Winnipeg.

Good progress is being made on the seven-storey reinforced concrete warehouse under erection at Toronto for Messrs. G. R. Gregg & Company. The architects are Messrs. Prack & Perrine, and the general contractors Messrs. Alexander Shunway & Utz Company.

At Edmonton, new stores and offices will be erected by Mr. J. N. Pomerleau, at a cost of $125,000. Plans are being prepared by Messrs. Hardie & Markland, Edmonton, for a four-storey building, 50 ft. by 150 ft. in dimensions, of reinforced concrete, brick and steel construction.

The Dominion Government's large elevator at Saskatoon has been completed and will be ready for operation on October [illegible] and is the largest [illegible] elevator in the world. There is accommodation for 3,000,000 bushels of grain.

The exterior work on the apartment house which Messrs. A. L. & J. A. Caron are erecting at Durochers Street, Montreal, at a cost of $108,000 is nearing completion. The new building is eight storeys high, 100 ft. by 50 ft. in dimensions, of brick and stone construction. The architects are Messrs. Gauthier & Daoust, Montreal, and the general contractor is Mr. G. Meloche, Montreal.

The City Council of Hamilton is contemplating the erection of a bridge [illegible] feet long at Burlington Heights. This structure is [illegible] with the Toronto-Hamilton concrete roadway project. The estimated cost of the bridge is $200,000. Mr. A. F. Macallum is City Engineer of Hamilton.

At Notre Dame de Grace (Montreal), foundation work is in progress on the new Catholic Orphanage, which is being erected at a cost of $175,000. The architect is Mr. A. Piche, of Montreal, and the general contractors are Messrs. [illegible] Deakin & Company, Limited, Montreal. The building is to be of stone and brick construction.

The Administration Board of the Greater Winnipeg water district has awarded contracts on construction amounting to over $6,000,000. The successful tenderers are all Winnipeg firms. Messrs. James H. Tremblay's award is for $945,945; Thomas Kelly & Sons, $1,301,485; and the Northern Construction Company, allied with Carter, Halls & Aldinger, for [illegible]

The widening of the Lachine Canal above the Cote St. Paul lock has been finished and as a result of the season's work of the Government contractors the curve which formerly made that part of the waterway difficult to navigate has been removed, portions of the canal now having more the appearance of a basin. The work has been carried out under the supervision of Lieut-Colonel H. R. Lordly, the Government engineer. In March last the work of remaking a portion of the canal was commenced, and the intervening seven months have seen a very considerable change. Although operations will not be discontinued entirely for another six weeks there only remain unfinished portions of the concrete wall of the canal which will form a wharf. Another part of the work, the power house building at Cote St. Paul, has to be completed, but this will not be done until next year. The cost of the eight months' work will amount to about $400,000. At times there have been as many as a thousand men employed on the contracts, and by the end of the season there will have been excavated more than 100,000 cubic yards of earth.

Building Materials Now Made of Rock

The marked increase in disastrous fires is directing more attention every day to the need of fireproof building materials that can be relied upon. The failure of many so-called fireproof materials when subjected to the intense heat of large conflagrations suggests the need of more careful judgment in the choice of these materials, as well as a more stringent interpretation of fireproof building regulations.

The demand for building materials that would not be affected by fire has encouraged manufacturers to experiment with all kinds of materials, but the only one that has thus far successfully withstood all tests is a peculiar rock known as Asbestos.

Asbestos runs in veins usually nearly parallel to the ground, in various thicknesses from a mere line to three or four inches thick. Some of these veins, however, reach a depth of 200 feet. In mining this rock, after removing the surface of the earth, the rock is drilled and blasted the same as granite or any other stone.

Deposits of asbestos, in one or more of its allied species, are found to a limited extent in Russia, Italy, Egypt, India, South Africa and, in fact, in all parts of the world. But that which is mined in Canada is about all that is of much commercial value, as other varieties are either too brittle to utilize or too hard to mine. By far the largest of these Canadian mines is owned by the H. W. Johns-Manville Company, of New York.

This asbestos rock, when properly worked, produces long silk fibres, which are manufactured into fireproof goods of various kinds, the most familiar of which, no doubt, is the asbestos theatre curtain.

These asbestos, or rock fibres, are made into felt, much along the line that the felt for hats is manufactured. This felt is then saturated with Trinidad Lake Asphalt, after which several of these sheets are cemented together with this material and thus made into ready roofings.

For shingles, these rock fibres are mixed with Portland cement and other ingredients, put into moulds of various sizes, and subjected to intense hydraulic pressure. The various colors are mixed with these ingredients, producing shingles of a number of handsome shades. Asbestos wood or lumber is also made in much the same manner as the shingles. Another use that is made of this material is in stucco, also wall plaster. Here the asbestos fibres take the place of hair ordinarily used and the asbestos rock takes the place of sand.

Another material which is fast gaining favor, chiefly because of its fire-retarding qualities, is Mastic, for floors.

The importance of fireproof construction can not be over estimated, and that architects and builders are fast realizing this is shown by the increase in the substitution of fireproof building materials for those of an inflammable nature.

Tubular Steel Tripod

Several novel features introduced into the construction of the Morris Folding Tubular Steel Tripod are described in bulletin Y17, of which a copy has been submitted to us by the Herbert Morris Crane & Hoist Company, Limited. One feature which will appeal to contractors, structural engineers, stone workers and other users of this kind of lifting gear is the ability to fold up the tripod without removing any bolts or pins. A broad flange is provided on each foot to enable the tripod to carry a load on soft ground, and a square point gives a good "grip" on harder surfaces. Another new feature is the provision of a small pulley at the top of the tripod by which a small rope can be used to haul up the heavy lifting block or to handle very light loads quickly. Every tripod is tested with a 50 per cent. overload, so that the safety of the user is always assured. It is worthy of note that even in the one-ton capacity the Tripod is light enough for one man to carry on his shoulder. Those who have had experience of hauling around the home-made wooden shear-leg will be able to appreciate this feature to the full.

Coming Road Congress in Chicago

Arrangements for the Eleventh Annual Convention of the American Road Builders' Association, which is to be held at Chicago, December 14-18 next, are nearing completion. We learn that essentially the same plan for the programme as that adopted at recent conventions will be followed. The various subjects to be treated have been so chosen as to cover the important phases of the three general divisions of the subject of highway work—Organization, Construction and Maintenance. Each topic will be introduced by a short paper presented by an authority especially selected for his knowledge of the subject on which he will speak. Among the topics to be treated are the following:—"Road and Pavement Dimensions—Widths, Depths and Crown;" "Road Foundations—Concrete, Telford, Gravel, etc.;" "Organization;" "Traffic—Present Tendencies, Probable Development and Regulation;" "Machinery for Construction and Maintenance;" "Brick Roads and Streets;" "Surface or Floors for Bridges;" "Bituminous Construction and Maintenance—Recent Practice;" "Concrete Roads;" "Recent Practice in the Construction of Wood and Granite Block Pavements;" "Earth and Gravel Road Construction;" "Street Paving in Small Cities;" "Convict Labor in Road Construction" and "Dust Prevention and Street Cleaning."

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Galt, Ont.
Town Council has had work started on construction of 4-ft. cement sidewalk on east side of Rowell Street, from Pollock Avenue to McNaughton Street. Work is being carried out by day labor, under supervision of Engineer. Mr. Jas. McCartney is the Clerk.

London, Ont.
Tenders close with W. G. Murray, Greene Swift Bldg., Architect, October 8th, for contract in connection with construction of 1 storey, 80 x 75, steel and brick garage on Dundas and Colborne, for Drs. H. A. and W. J. Stevenson, 391 Dundas Street.

Leamington, Ont.
Town Council has in contemplation laying of mains from Lake and installing additional equipment to waterworks system. R. M. Selkirk is clerk.

Medicine Hat, Alta.
Flour Mill for Maple Leaf Milling Company, Board of Trade Building, Toronto, general contractor for which is Geo. H. Archibald & Company, 827 Union Bank, will be completed by November 1st.

Notre Dame des Laurentides, Que.
Tenders have been called by Municipal Council (Sec.-Treas., Luc Pelletier), for gravelling road, the general contractor of which is J. B. Cloutier, St. Romould. Estimated cost is $12,750.

Niagara-on-the-Lake, Ont.
Plans are in progress for macadamizing and concrete curbing on Queen Street, for Town Council. W. E. Lyall is clerk; J. C. Gardner, Queen Street Niagara Falls, Ont., engineer.

Ottawa, Ont.
Plans have not as yet been prepared for Watson Carriage Company's $15,000 plant to be located on Murray and Friel Streets. Old building has been razed. Mr. Plank is the manager.

Tenders on paving [illegible] block and 820 lineal ft. gutters on York Street, estimated to cost $7,000, will be called shortly by City Council. F. C. Askwith is Engineer.

Oshawa, Ont.
A conference is to be held shortly with regard to contemplated Cement Roadway to be constructed between Oshawa and Toronto. Town Council and Provincial Government are jointly interested.

Stamford Twp., Ont.
Township Council is laying 4 miles of Water Main upon which work has started. Frontier Construction Company, general contractors, Niagara Falls, Ont.

Summerland, B.C.
The contract for part of the work of raising dam at Trout Creek has been awarded to Mr. Robert Mitchell. City will require to raise an additional $2,500 to complete the scheme.

Stratford, Ont.
Town Council has in contemplation construction of Main Sewer through town to relieve present reported congestion. No plans or estimates have yet been prepared. A. H. Manson, City Hall , is the engineer.

South Vancouver, B.C.
City Council will have tenders called shortly for $9,000 Fire Hall. Building Inspector Hubbard is the architect, and Wm. McQueen is the Clerk.

St. Hyacinthe, Que.
By-law is to be submitted to ratepayers on October 15th for approval to construct $10,000 Artificial Stone Factory for Frederic Dienlefet, Roxton Falls, Que.

Toronto, Ont.
Tenders will be received until October 13, by Board of Control, for—Asphalt pavements, five streets; brick block, one street; grading, 13 streets; concrete curbing, two streets; concrete sidewalks, seventeen streets, sewers, one street.

Transcona, Man. (Winnipeg)
Work is started on construction of 12-in. cast-iron pipe line extending from Pump House at St. Vital to reservoir at Transcona, a distance of approximately 31,000 ft. Work is being carried out for Transcontinental Railway Commission. Secretary, B. E. Ryan, Ottawa. General contractors, Manitoba Engineering & Contracting Company, 502 Union Bank Building, Winnipeg. Estimated cost $87,000.

West Vancouver, B.C.
The Municipal Council has approved scheme for construction of Waterworks System and steps are being taken to have by-law passed. The estimated cost is $150,000. Mr. H. L. McPherson is Municipal Engineer.

Winnipeg, Man.
Work by day labor is to start shortly on Refectory Building, Kildonan Park, for Parks Committee, Board of Control. Only foundation will be put in this year. Geo. W. Northwood, 1502 Northern Crown Building, is the Architect.

Board of Control will receive tenders until October 13 for valves for domestic service waterworks. M. Peterson, Secretary, W. P. Brereton, Engineer.

CONTRACTS AWARDED

Cloverdale, B.C.
Surrey Council has awarded the following contracts for grading: Pattison & Lester at [illegible] for building Clover Valley road at Hazelmere; Parsons, Stone & Bradley, at 5½c per lineal ft., for ditching Hall's Prairie road.

Esquimalt, B.C.
Contract for construction of Village Sewer System at estimated cost of $15,000 has been awarded to H. Macdonald. Work will begin at once.

Ford City, Ont.
Council of Ford City has awarded contract to resurface Sandwich Street from Askins Point to Westerly limits of Walkerville in Ford City, approximately 12,000 square yards, to the Canadian Dolarway Paving Company, Limited, Windsor, Ont.

Hamilton, Ont.
The contract for laying 324 ft. of 12-in. iron pipe sewer on Cumberland Ave. has been awarded by City Council to J. D. Armstrong, 138 Erie Avenue.

Joliette, Que.
Town Council has awarded contract for construction of reinforced concrete dam, intake pipe, alterations to plant and supply of pumps, in waterworks extension scheme, estimated to cost $33,000, to Arsenault & Plamondon, of Joliette. Surveyer & Frigon, 56 Beaver Hall Hill, are the Engineers.

Leamington, Ont.
The general contract for construction of curbs and gutters to cost about $6,000 has been given by Town Council to Geo. Scratch.

London, Ont.
The fololwing contracts have been allocated by City Council for construction of sanitary sewers, totalling approximately $8,685: Fielder Construction Company—Gordon Street—$431.32; Wm. McCracken—Belgrave Avenue—$1,[illegible]; City Engineer's Department—Gerrard Street and Carlton Avenue—$1,307 and $696.20 respectively; McKay, McKay & Webster,—William Street—$2,325; W. J. Johnston Company—Carfrae Crescent—$2,575. Wm. N. Ashplant is Engineer.

Minto Township, Ont.
Crowley & McDonald, Gads Hill Station, Ont., have been awarded general contract for construction of approximately six miles of drains at $9,240. W. D. McLellan, Harriston, Ont., is Clerk.

Ottawa, Ont.
The general contract for asphalt pavement on various streets at an estimated cost of $40,000, has been awarded by City Council to Ottawa Construction Company, Central Chambers. F. C. Askwith is Engineer.

Tillsonburg, Ont.
Town Council has authorized extension of water mains to factory of Borden Milk Condenser Company. A. E. Raynes is clerk.

Toronto, Ont.
The following contracts have been awarded by Board of Control in connection with construction of sewers: McKnight Constr. Company, 88 St. Davids Street—Balfour, $1,448; Connolly Agnew Company, [illegible]

[illegible] $4,542; M. B. Murphy, 84 Dominion Street—Coleman, $2,686; W. E. Larkin, 488 Clinton Street—Laumount, $878; J. McGuire, 126 Spadina Road—Powell, [illegible] $900; Grant Contracting Company, 50 Front E.—lane, $5,365; J. [illegible] on Indian Road—Weatherell, $[illegible]; Commr. of Works, Crown Park Road, $1,150.

Board of Control has awarded contracts for asphalt pavements as follows: Constr. & Paving Company, Limited, Central Life Bldg.—Day Street, $11,564, Morrison $13,489, Main $5,000, Sellers $[illegible]; Commr. of Works—Earlscourt $4,898, Goodwood $6,044, Greenwood $9,-[illegible], Hope $8,772, Innes $1,953.

The following contracts for construction of pavements, etc., have been awarded by Board of Control (Mr. R. C. Harris, City Hall, Commissioner of Works): Grant Contracting Company, 50 Front E., concrete on Glengrove, $8,654; Britnell Contracting Company, 927 Yonge Street, concrete on Glenview, $1,874; Britnell Contracting Company, 927 Yonge Street, curbing on Rosemount; Commr. of Works, concrete on Glencairn, $7,974, and on lane, $668; Standard Concrete Paving Company, 74 Moscow Avenue, concrete walks on St. Clair.

Commissioner of Works, R. C. Harris, City Hall, has awarded following work by day labor for pavements: Bitulithic on Felstead, $5,948; Lamb, $11,205; brick block on Bain, $4,845; St. Clair, $12,000.

Vancouver, B.C.

The general contract for construction of Office Building on Hornby Street at estimated cost of $20,000, has been awarded to Glover Lloyd, 1689 Robson Street, and for excavating to Plummer & Brown, care general contractor. Tenders will be invited shortly for different trades. National Mercantile Company, 420 Winch Building, are owners and architects of the building, which will be brick, steel and mill construction.

Tenders for material will be called shortly in connection with construction of sewers on Balaclava at estimated cost of $150,000. Wm. McQueen is clerk and F. L. Fellows engineer. Work is to be done by day labor.

Victoria, B.C.

The general contract for $80,000 Jail, 4-storey, artificial stone, concrete and brick construction, has been awarded by City Council to A. W. Carkeek & Company, 618 Sayward Building. J. C. M. Keith, 416 Sayward Building, is architect.

Regina, Sask.

The general contract for $10,000 Warehouse on 8th Avenue and Smith, for McKenzie-Hazel Supply Company, Limited, Mickleboro Block, has been awarded to Cushing Bros. Company, Limited, Dewdney Street. Building will be one storey, 50 x 100, frame construction, steel, metal siding.

J. T. Wing & Company, Windsor, have awarded the contract to Leo. Weiss, Detroit, Mich., for constructing four-storey and basement warehouse, 100 x 100 ft. James Pennington, La Bell Bldg., Windsor, is architect.

Winnipeg, Man.

Board of Control has awarded the contract to J. W. Astley, engineer of construction, for laying of asphalt No. 2 pavement on Stiles Street, at $5,283.85.

J. W. Astley, engineer of construction, has been given the contract for construction of sewers in the following streets: Lark, $418; Minto, $2,072.65; Richard Avenue, $1,005.

Contract for construction of sewer connections and plumbing work has been awarded by Board of Control to Jas. Brown, 369 Atlantic Avenue, at $1,204.

Railroads, Bridges and Wharves

North Vancouver, B.C.

Plans are being prepared and tenders will be called shortly for another unit of Shipbuilding Plant at Lynn Creek for Dominion Shipbuilding and Dry Dock Company, Limited, 14 Canada Life Building, estimated cost of which is $5,000,000. This will include Machine Shops, 2 Marine Railway Buildings and 2 Concrete Wharves.

St. Stephen, N.B.

The substructure has been started in connection with Wharf on St. Croix River for Dominion Fertilizer Company. Mr. Eckert is the Superintendent.

Toronto, Ont.

Board of Control has extended time for receiving tenders on Bloor Street Viaduct until October 13.

Tenders will be received until noon, October 13, by Mayor H. C. Hocken, Chairman, Board of Control, for Argyle Street Storm Overflow Sewer, Section No. 2.

Victoria, B.C.

Plans are drawn and by-law mill be submitted to ratepayers this year for construction of bridge on Johnson Street, estimated to cost $750,000. Wellington J. Dowler, is City Clerk.

Windsor, Ont.

Work is proceeding on construction of reinforced concrete floor for bridge, approximately 10,000 sq. yds., on Wharncliffe Road, for City Council. Wm. Ashplant is Engineer.

CONTRACTS AWARDED

Elgin County, Ont.

The contract for construction of four Iron and Cement Bridges in Dunwich and Aldborough Townships has been awarded by County Council to Sarnia Bridge Company, 176 North Street, Sarnia. K. W. McKay, St. Thomas, is the Clerk, and J. A. Bell & Son, Court-House, St. Thomas, are Engineers.

Galt, Ont.

The general contract for construction of one-storey 20 x 30 ft. brick station, estimated to cost $5,000, for Lake Erie and Northern Railway, has been awarded to P. H. Secord & Sons, Limited, 133 Nelson Street, Brantford.

Public Buildings, Churches, and Schools

Bassano, Alta.

The Department of Public Works, Ottawa, has awarded the contract to M. C. Sackrider, Medicine Hat, for constructing public building at Bassano.

Brantford, Ont.

Municipal Street Railway Commission proposes rebuilding East Ward Loop and constructing loop to connect Palmerston Avenue with Brant Avenue line.

Canso, N.S.

Tenders will be received until 4 p.m. October 19, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa, for Electrical Fixtures and Wiring in public building. Plans and specification with caretaker, public building, Canso, at office of Mr. Bishop, Superintendent of Public Buildings, Halifax, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Limited, Toronto.

Ford City, Ont.

All contracts are let in connection with Town Hall and Fire Station on Sandwich Street, estimated to cost $20,000.

Fort Rouge, Man. (Winnipeg)

Contracts will be awarded in about two weeks for addition to church estimated to cost $77,000, for Christian Scientists. Building will be brick and local stone construction. Jordon and Over, Canada Life Building, Winnipeg, are the architects.

Hamilton, Ont.

Plans are completed and awaiting approval of Provincial Health Inspector, Toronto, in connection with $200,000 Hospital on Mountain Top for City Council. Tenders for foundation work will be called shortly and other tenders will be invited next spring. Building will be three storeys and consist of three wards. Stewart & Witton, 2 Hughson Street South, are the architects.

Langley Prairie, B.C.

Tenders are being received by J. E. Griffith, Victoria, Minister of Education, for erection of frame school buildings for Provincial Government, Department of Public Works.

Noelville, Ont.

Work is to start on construction of $25,000 church for R. C. Diocese of Sault Ste. Marie. Building will be 50 x 130, concrete block veneer construction. Angus & Angus, Box 229 P.O., North Bay, are the architects. Work will be done by day labor.

Regina, Sask.

Tenders are being received by L. A. Thornton, Commissioner, for decorating interior of City Hall.

St. Joseph de Beauce, P.Q.

Tenders will be received by Sec., Presbytery of St. Joseph de Beauce, until October 20 for construction of foundations and pedestal for monument in standstead granite. Plans, etc., are at Presbytery.

Stratford, Ont.

Contract for one-storey addition to Baptist Church has been awarded to W. Bradshaw, Water Street. J. S. Russell, 21 Downie Street, is the architect.

Toronto, Ont.

W. C. Wilkinson, Sec.-Treas., Board of Education, will receive tenders until October 9 for all trades in connection with construction of Givens Street School. Tenders also invited on heat regulators, local telephones on Sunday Schools and concrete retaining wall at Balmy Beach School.

Vancouver, B.C.

Sharpe & Thompson, Architects, Vancouver, are preparing plans for erecting a number of buildings at Point Grey for B. C. University.

CONTRACTS AWARDED

Oakridges, Ont.

Contract for construction of $100,000 School for Christian Brothers has been awarded to Thompson Bros., 151 Rusholme Road, Toronto. Mr. J. P. Hynes, 199 Yonge Street, Toronto, is the architect. Building will be four storeys, 180 x 60 feet, stone, fireproof and brick construction.

Toronto, Ont.

Board of Education has awarded the following contracts in connection with addition to Huron Street School: Masonry, Albert Webb, 13 Shirley Street, $15,400; carpentry, J. D. Young & Son, 160 Rusholme Road, $7,550; heating and ventilating, W. J. McGuire, 85 King Street West, $3,100; painting, J. R. Robinson, 425 Sumach Street, $840; roofing, A. Matthews, Limited, 256 Adelaide Street West, $991; plastering, Geo. White, 688 Kingston Road, $1,800; electric wiring, A. R. Rice Company, 152 Bay Street, iron stairs, Canadian Ornamental Iron Company, Limited, 88 River Street.

Wakaw, Sask.

Wakaw School District No. 1138 has been authorized by Local Government Board to raise debentures for erecting $8,000 school, two-storey, two-room, brick veneer construction. Otto C. Reimer, Wakaw, is Secretary-Treasurer.

Business Buildings and Industrial Plants

Brampton, Ont.

It is reported that an American firm which manufactures furniture decorations, piano cases, electric light fixtures and interior decorations, is desirous of obtaining suitable building site for establishing factory at Brampton.

Barrie, Ont.

Several trades have yet to be let in connection with construction of Stores and Apartments on Elizabeth Street, for D. Haisberg, 106 Dunlop Street, at estimated cost of $8,000. Ball Planing Mill Company, Bayfield Street, are the general contractors.

Bury, Que.

Harold Webster has the building of a garage in contemplation.

Calgary, Alta.

Oil Exchange has obtained permit to carry out alterations to Business Block. Mr. McInnis, 9th Avenue W., is interested.

Clachen, Ont.

The construction of farm buildings estimated to cost $3,000 is contemplated by Philip Kearn.

Edmonton, Alta.

Work is to be completed this fall on $25,000 Hotel and Store for W. H. Connor, Imperial Hotel. Hardie & Martland, Victoria Block, are the architects.

Hullett Twp., Ont.

The construction of $3,000 Farm Buildings is contemplated by Mr. W. [illegible]man, owner and architect, Blyth P.O., Ont.

Jacquet River, N.B.

Louison Lumber Company, Limited, is erecting a lumber mill. Work will be carried out by day labor.

Maisonneuve, Que. (Montreal)

General contractors, Anglins Limited, 65 Victoria Street, are taking tenders on mill work and roofing in connection with $70,000 four- storey brick warehouse for St. Lawrence Sugar Refineries, Limited.

Montreal, Que.

Permit has been issued to Seminaire St. Sulpice, 66 Notre Dame W., for one-storey, concrete foundation alterations to store on 312 St. Catharine East.

Permit has been issued to H. Leblanc, 2559 Molson, for alterations to flat.

Morris Twp., Ont.

The erection of $3,500 farm buildings is contemplated by Alexander McEwen, Clerk, Morris Twp., Brussels P. O.

New Westminster, B.C.

Plans are in progress and tenders will be called shortly for construction of Elevator and Warehouse on Front Street, estimated cost $20,000. Brackman-Ker Milling Company, Front Street, are owners, and Gardner & Mercer, Trust Bldg., architects.

Niagara Falls, Ont.

Contracts for heating, plumbing and electrical work have not yet been let in connection with $40,000 Lodge Hall and Stores for I. O. O. F. J. Blair, Morrison Street, has the general contract which includes all other trades.

North Easthope, Ont.

John Berett, New Hamburg P. O., is contemplating erection of farm buildings, estimated to cost $4,000.

Oakville, Ont.

Contracts have not yet been let in connection with $5,000 garage and repair shop on Dundas Street, for Whittaker Bros. Building will be two storeys, 100 x 80, solid brick construction and modern equipment will be installed throughout.

Ottawa, Ont.

Robert Brown, 376 Sparks Street, has in contemplation the construction of steel and brick workshop on Queen Street. Estimated cost $7,000.

Red Cliff, Alta.

The construction of large Glass Plant covering five acres is contemplated.

St. John, N.B.

Maritime Dredging & Construction Company, general contractors, are erecting two temporary Warehouses on mud sills for winter port work for Dominion Government Department of Public Works. Buildings will be frame construction, felt and gravel roofing.

Thamesville, Ont.

Work is started on repairing interior of drug store for A. M. Dow, which was [illegible]

Tilbury, Ont.

Plans are being drawn by [illegible], owner and architect, for construction of store and apartments [illegible] construction, concrete and stone foundation, at estimated cost of $10,000.

Timmins, Ont.

Work is to be done by day labor on $20,000 rink for Canadian Mines Finance Company, Timmins.

Toronto, Ont.

Plans are drawn for alterations to Store and Office on Dundas Street for Messrs. Catalano & Sansone, estimated to cost $3,000. Mr. J. E. Orme, 175 Sydenham, is the general contractor, who is doing all work by day labor.

Tenders for smaller trades will be called later in connection with $15,000 stores to be erected on Dundas Street for S. Finegold, 2158 Dundas Street. Stores will be two storeys, brick construction.

The construction of Blacksmith's Shop on Danforth, near Greenwood, is contemplated by C. W. Burns, 724 Danforth Avenue. Building will be frame and galvanized iron construction.

Plans are in preparation for construction of Machinery Hall at Exhibition grounds. Mr. Geo. Gouinlock, Temple Building, is the architect. By-law will probably be submitted on January 1st.

Permit for one pair store fronts and interior alterations, estimated to cost $2,000, has been granted to C. Smith, 619 Queen Street West.

Vermillion, Alta.

Work has been started on foundations for $5,000 bank for Royal Bank of Canada, 460 Main Street, Winnipeg. Building will be brick construction. Claydon Bros., Furby Place, Winnipeg, are general contractors.

Victoria, B.C.

The City Council has accepted the following tenders for Headquarters Building and City Jail: Mr. Chas. W. Carkeek, $55,908 for building work; Hayward & Dodds, $6,239 for sanitary work; Carter & McKenzie, $4,990 for electric wiring and installation; R. J. Nott & Company, heating, $5,568. Building is to be completed by August 1st, 1915.

CONTRACTS AWARDED

Guelph, Ont.

The following contracts have been awarded in connection with $[illegible] Skating Rink for Victoria Skating Rink: General contractors, Johnson & Willims; carpentry, Geo. Ibbotson; plumbing, Fred Smith. Building will be two storeys, 176 x 82, brick construction. W. A. Mahoney, Telephone Bldg., is the architect.

Preston, Ont.

The general contract for construction of $25,000 store, 12 x 55 ft., brick construction, for Miss Cowan, has been awarded to D. Gatehouse, Church Street.

Waterloo, Ont.

The contract for carpentry work in connection with construction of three stores for M. A. Fischer has been awarded to Richard Krols, Preston.

Residences

Amherst, N.S.

Contracts have not yet been let in connection with $8,000 2½-storey frame residences for Geo. T. Douglas, 192 Victoria Street.

Calgary, Alta.

Permit has been issued to J. W. Watson, [illegible] Twelfth Avenue N.W., for two residences.

Permit has been issued to D. Little, [illegible] Twenty-third Avenue N.W., to erect residence.

S. Turner, 120 Eighth Avenue N.W., has obtained permit for construction of residence.

Edmonton, Alta.

Plans have been drawn by T. Ramsay, [illegible] Twenty-fifth Street, architect and general contractor, for construction of two-storey frame residence on First Street, estimated to cost $4,000.

Grimsby, Ont.

Site has been purchased for residence to be constructed by P. H. Secord, 133 Nelson Street, Brantford, general contractor for Mrs. P. H. Secord.

Guelph, Ont.

Plans are drawn for two-storey brick and stone residence for Wm. P. Cook, 52 Tiffany Street, who is also architect and general contractor.

London, Ont.

A permit has been issued to G. M. Reid, 262 Central Avenue, to erect two-storey brick veneer residence on 32 Byron Avenue.

Tenders will be received by Messrs. Watt & Blackwell, architects, Bank of Toronto Chambers, until October 8, for construction of $8,000 frame residence, concrete foundation, on Hyman Street, for W. E. Saunders, 247 Central Avenue.

Montreal, Que.

A. L. Byers & Company, 340 University Avenue, general contractors, are still taking prices on tiling in connection with 2½-storey, 50 x 36 brick and stone residence on Dorchester W., for R. E. Powell, 1363 Green Avenue.

Prices on plastering are still invited by A. L. Byers & Company, general contractors, 340 University Avenue, in connection with construction of Nurses Home on Charron, for Alexandria Hospital.

Niagara Falls, Ont.

Contracts for plumbing, heating and electrical work are to be let in connection with $5,000 Residence on Bamfield for Dawson Brothers, Queen Street. General contractor H. Scott, Terrace Avenue, has all other trades. Building will be 31 x 40, frame construction.

Ottawa, Ont.

Alterations to residence of T. Ladiesour, 477 Besserer, are in contemplation.

Wm. Glennie, 183 Hawthorne, is contemplating building $4,000 Residence on Rosemere Avenue, to be two storeys, 35 x 28, double brick veneer construction.

F. Doimouchell, 114 Forward Avenue, contemplates building residence.

The construction of $5,000 brick veneer residence on Mary Street, is contemplated by T. Linton, 7 Centre Street.

Point Grey, B.C.

Owner and architect, Alexander McDonald, 3225 Verables Street, has plans drawn for Residence.

Sharon, Ont.

Plans are in progress by Jos. Allen, Lambeth P. O., owner and architect, for construction of $3,000 white brick residence.

Toronto, Ont.

Work is started on construction of seven detached Residences on Lyndhurst Avenue, at estimated cost of $50,000. Owner and general contractor, Gibson Bros., 44 Adelaide West. Construction will be two-and-a-half storeys, 50 x 40 ft., stone and brick.

Smaller trades will be sub-let by owner and general contractor, E. Bennett, 86 Empire Avenue, in connection with pair $5,000 Residences on 81 Wrenson Road, two storeys, 38 x 40 ft., brick construction. General contractor is also doing masonry and carpentry.

Tenders are wanted by W. E. McMullen, 411 Manning Chmbrs., owner, for roofing, plastering, painting and electrical work in connection with 2½-storey, 24 x 38, brick detached residence on Pleasant Avenue, estimated to cost $6,000.

Permit has been issued to J. W. Fisher, 18 Hamblay Avenue, for addition to residence.

A. G. Thompson, 867 Carlaw Avenue, has obtained permit for addition to residence, 2½-storeys, brick construction.

J. Thorn, 221 Woodbine Avenue, has obtained permit for detached residence, two storeys, brick construction, on 26 Du Vernet.

Permit has been issued to A. H. Fisher, 114 Church Street, to build two-storey, brick, detached residence.

Detached residence will be constructed on 628 Jones Avenue, by W. E. Hill & Son, 228 Browning Avenue, owner and general contractor.

Permit has been issued to H. A. Farthing, 169 Leslie Street, for pair Residences.

Smaller trades are to be sub-let by owner and general contractor A. H. Power, 144 Fulton Avenue, in connection with $4,000 detached residence on Butternut Avenue.

Winnipeg, Man.

Work is to commence on $10,000 residence, 2½-storeys, 33 x 40, pressed and common brick construction, for Genser Bros., 98 Lusted Street, who are the general contractors.

Plans are drawn by E. E. Wire, 217 Kennedy Building, and work will start at once on alterations to residence.

Windsor, Ont.

Tenders will be called October 12 and will close October 24 for general contract to construct $5,000 Residence on Victoria Avenue for I. S. McCallum. Building will be two storeys, 30 x 36 ft., stucco and brick construction. G. Jacques & Company, 171 Wyandotte East, are the architects.

CONTRACTS AWARDED

Guelph, Ont.

The contract for construction of Residence on Tiffney has been awarded to Benalick Bros., Hearn Avenue, by owner and architect, James Kirby.

Niagara, Falls, Ont.

The contract for residence for M. Abbabott, c/o E. Davis, River Road, has been awarded to J. E. Gardner, 10 Morrison Street. Heating, plumbing and electrical work are to be let. General contractor has all other trades.

Point Grey, B.C.

General contract for construction of Residence on Balsam Street, has been awarded by F. C. Smith to W. J. Barstow, 1134 Robson Street.

Walkerville, Ont.

The contract for carpentry, roofing, plastering and painting on $16,000 Residence to be constructed on Kildare Rd. for Mrs. E. C. Walker, has been awarded to Schmeid & Sisman Company, 352 to 405 Beaufeit Avenue, Detroit, Mich. Residences will be two-storey, 80 x 35 ft., hollow tile construction, concrete and brick foundation. Stahl, Kinsey & Chapman are the architects.

Power Plants, Electricity and Telephones

Chatham, Ont.

Plans are in progress in connection with repairs to elevator for Canada Flour Mills, Limited, 31 Thames Street. Estimated cost $3,000. Building will be concrete and brick foundation. Messrs. Adams & Adams, 49½ King Street, are architects.

Essex, Ont.

Essex County Light & Power Company contemplates erecting an outside transmitter, also purposes to connect various lines to supply the town with power.

Halifax, N.S.

Tenders will be received by Mr. R. C. Desrochers, Sec. Dominion Government Department Public Works, until 4 p.m., October 9, for supply of two single Scotch boilers 11 ft. 6 ins. in diameter and 10 ft. 6 ins. long, working pressure 130 lbs., per square inch. Delivery at wharf next I. C. R. terminal, Halifax. Plans and specifications at office of district engineers, Toronto, Montreal and St. John, and A. B. Crosby, Halifax. Specification at office of MacLean Daily Reports, Limited, Toronto.

The Sec., Department Public Works, R. C. Desrochers, Ottawa, will receive tenders until 4 p.m. October 9, for supply of one set inverted fore-and-aft Compound Surface, Condensing Engines. Cylinders about 20 x 42 ins. in diameter by 27-in. stroke for 130 lbs. working pressure, delivered at wharf next I. C. R. terminal, Halifax. Plans and specification at office of district engineers, Toronto, Montreal and St. John, and A. B. Crosby, Halifax. Specifiiation at office of MacLean Daily Reports, Limited, Toronto.

Leamington, Ont.

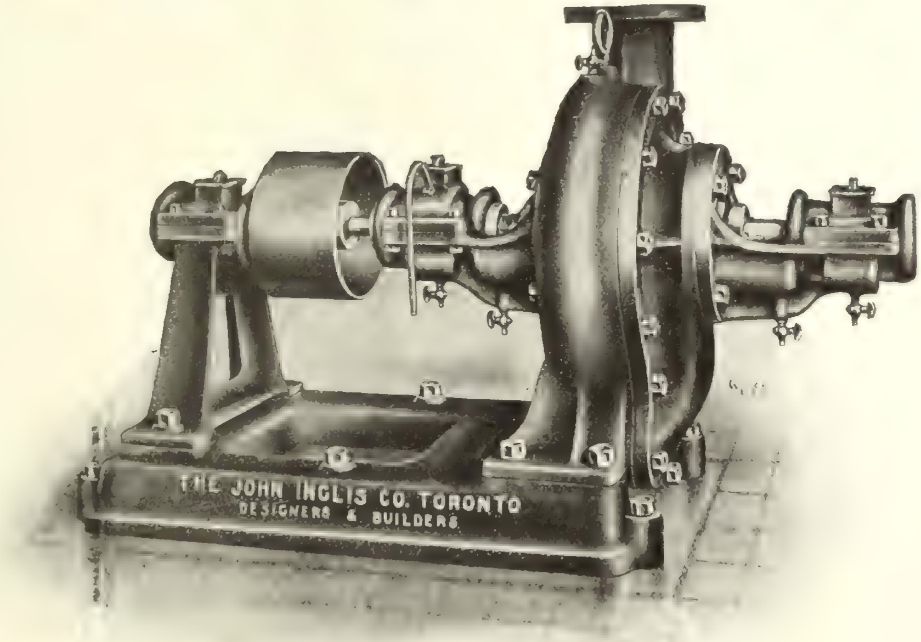
Hydro-Electric Commission is preparing estimates of cost of installing Electric Distributing System at Leamington.

London, Ont.

Plans are in preparation for new Hydro line from London and St. John to Lucan, also a branch to Masonville, by Hydro-Electric Commission of Ontario.

A scheme for provision of Incinerator at an approximate cost of $50,000, has been approved by Board of Control. By-law has yet to be submitted to ratepayers. Arch. Currie is City Engineer,

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Ottawa, Ont.

Application is to be made to Parliament next session by Brantford & Hamilton Electric Railway Company for extension of time in connection with radial railway system.

St. John, N.B.

Tenders will be received by Francis S. Walker, sanitary engineer, 18 Germain Street, for installation of boiler fittings for heating plant at new hospital. Plans and specification at office of engineer. Specification at office of MacLean Daily Reports, Limited, Toronto.

Sydney, N.S.

City Council will receive tenders until October 31 for supply of one 2,200-volt, 3-phase, 60-cycle freshwater Turbine Pump and 1 S. all-air Priming Pump. Plans and specifications at office of engineer, Norman Hay. Specification at office of MacLean Daily Reports, Limited, Toronto.

Toronto, Ont.

City Council has selected sites for location of Incinerator plants. Plans are in preparation and will probably be ready about middle of November. Mr. Wilson is Street Commissioner.

Winnipeg, Man.

Board of Control will receive tenders until October 8 for boiler for steam fire engine. Specification with engineer.

Miscellaneous

Duncan Station, B.C.

Tenders will be received by R. C. Desrochers, Secretary, Department Public Works, Ottawa, until 4 p.m. October 26, for interior post office fittings. Plans and specification are at office of Postmaster, Duncan Station; Wm. W. Henderson, Resident Architect, Victoria, B.C., and at Department, Ottawa.

Hamilton, Ont.

Mr. R. S. Davidson, Concession Street, contemplates the purchase of machinery and equipment for small steam Grist Mill.

Subcontract for supply of cement blocks for Dominion Government revetment wall, has been awarded to E. V. White, Burlington. D. G. Stewart, Alexander Hotel, Ottawa, is general contractor.

Perth, Ont.

General contractor, W. J. Rabb, Perth, requires material for asphaltum floors in connection with addition to institute for Board of Education. Sub-contract for plumbing and roofing is to be let.

Prince Rupert, B.C.

Board of Trade has received inquiry from Alberta for detailed information regarding preliminaries in connection with probable establishment of Biscuit and Confectionery manufactory, Brick Works and Dairy business.

Sarnia, Ont.

The Reid Wrecking Company, of Sarnia, Ont., has received contract from United States Government for raising of sunken lightship No. 88, which went down in Lake Erie, near Buffalo, November, 1913. Work will be started at once.

Steelton, Ont.

Tenders for interior post office fittings will be received by Secretary, Department Public Works, Ottawa, R. C. Desrochers, until 4 p.m. October 9. Plans and specification are at offices of Mr. Wm. Goodwin, Clerk of Works, Steelton; Mr. T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and at Department, Ottawa.

Walkerville, Ont.

In connection with $15,000 Stores and Offices which are about completed for John Bater, Victoria Avenue, Windsor, store fixtures will be required by Baker Bros., Grocers; Chairs, tables and fixtures will be wanted by Mr. White, Quick Lunch Room, both of whom are occupants.

CONTRACTS AWARDED

Paris, Ont.

The contract for installation of Heating System in municipal building has been awarded by Town Council to Donald Sinclair, at $1,275.

St. John, N.B.

The contract for erecting iron and concrete fire escapes and balconies for Hospital has been awarded by Hospital Commissioners to Phoenix Foundry Company, Pond Street. F. Neil Brodie, Princess Street, is the architect.

Vancouver, B.C.

An order has been received by Canada Wire & Cable Company (agents, Macdonald Marpole Company, Vancouver) from the West Kootenay Power Company for 18½ miles of Bare Head Drawn Copper Wire.

Business Notes

Berlin, Ont.

Barns and driving shed belonging to Simeon Brubacher, Edna Street, have been destroyed by fire. Loss, estimated at $10,000, is partly covered by insurance.

Edmonton, Alta

Conotolite Marble Company, Edmonton, has been formed for the manufacture of artificial marble. H. E. Luhan, Higlands Avenue, is interested.

Essex, Ont.

Business block owned by O. H. Bricker and occupied by W. H. Richardson Furniture Warehouse, has been burned down, involving $45,000 loss. Insurance $40,000. Owner may rebuild.

Galt, Ont.

Store on Main Street, owned by N. Brock Wilkins, 113 Bernard Avenue, Toronto, and occupied by F. J. Brown & Sons, Oriental Bazarr, has been destroyed by fire. Loss estimated at $10,000, is covered by insurance.

Lindsay, Ont.

Contract for interior fittings in connection with building $5,000 Rectory for St. Paul's Anglican Church has not yet been let. W. Blackwell, Peterborough, is the architect.

London, Ont.

Hoskins & Reynolds, 5 Dundas Street, have sustained the loss of $1,000 from fire in their grocery warehouse.

Vault doors and fittings will be required in connection with construction of vault with reinforced concrete walls, for Merchants Bank, 608 Dundas Street. J. C. Fletcher, Madison Avenue, is general contractor.

Niagara Falls, Ont.

Dr. T. E. Watson contemplates rebuilding barn which was destroyed by fire recently.

North Bay, Ont.

Public School Board has not yet awarded contract for interior fittings in connection with school estimated to cost $25,000. J. H. Marceau, 237 First Avenue, is general contractor.

Ottawa, Ont.

The Union Construction Company, Bank Street Chambers, Ottawa, are in the market for 12 or 15-ton tandem steam roller.

St. John, N.B.

John Neilson, St. John East, whose two residences have been destroyed by fire, intends to rebuild. Loss is reported at $6,300; insurance $4,500.

St. Stephen, N.B.

Shoe factory owned by Clark Bros., King Street, together with residences and blacksmith shop, has been destroyed by fire. Loss estimated at $35,000.

Welland, Ont.

Electric Steel & Metals Company, Limited, has received contract from British War Office, through Canadian Dept. Militia & Defence, for manufacture of sharpnel shells. Additional machinery is being installed.

Windsor, Ont.

Business block, owned by Shand Bros., grocery warehouse, and occupied by Singer Sewing Machine Company, Tribune Publishing Company, and Stevens Photographic Studio, has been destroyed by fire. Loss covered by insurance.

Late News Items

Centreville, N.B.

Hotel and business block was destroyed by fire. Loss estimated at $40,000. No particulars of insurance.

Fort William, Ont.

City Council has awarded a contract to John Millen & Sons, Toronto, for furnishing equipment for municipal electric railway construction in Fort William.

Hamilton, Ont.

City Council has decided to proceed at once with construction of East-End Sewer at an estimated cost of $100,356, of which ratepayers' share will be $32,000. Plans will be submitted for approval of Provincial Board of Health, and City Engineer Macallum will call for tenders at once.

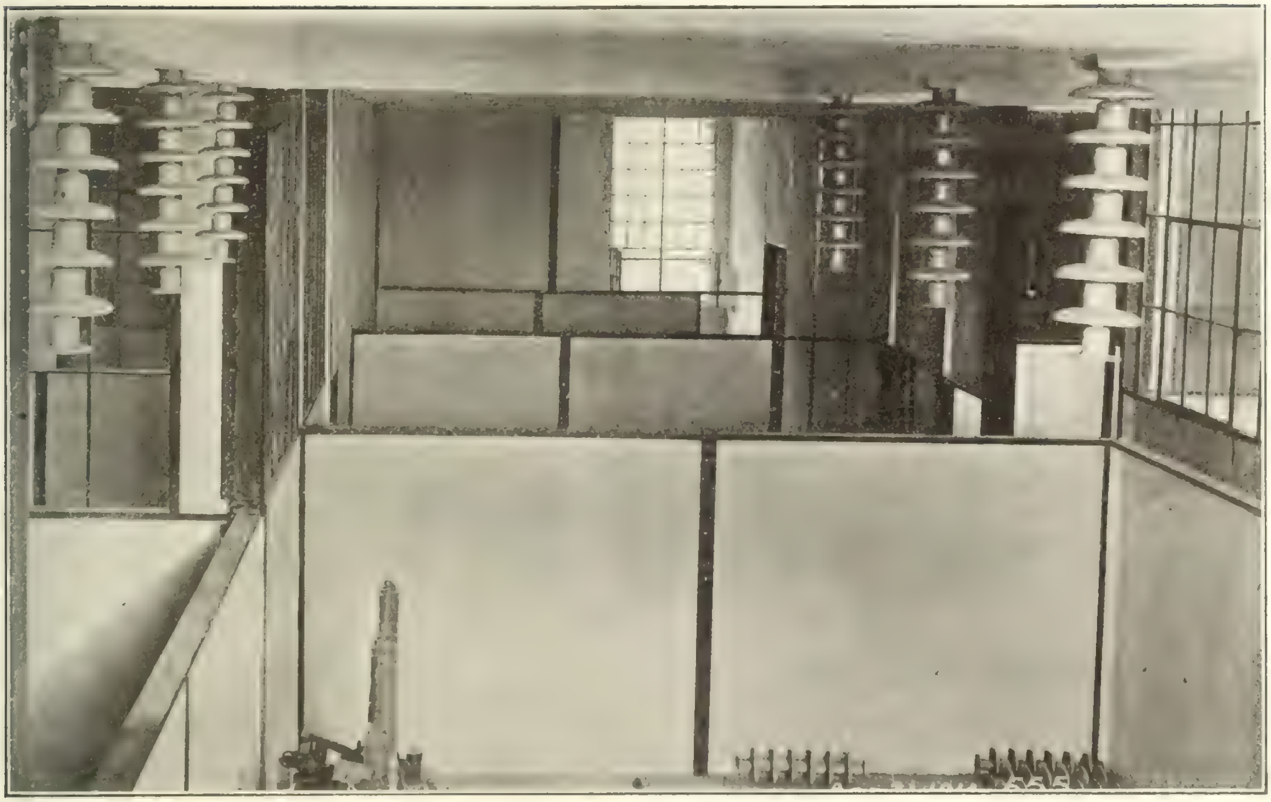
Secretary, Board of Education, R. H. Foster, will receive tenders until October 13 for $80,000 school to be erected on Wentworth Street North, two storeys, 12-roomed, brick construction. Plans and specification are at office of architect, A. W. Penne, 107 Clyde Block.

New tenders will be received by R. H. Foster, Secretary, Board of Education, until October 30, for School on Dundas Street, South, to be two-storey, brick construction. Plans and specification at office of architect.

Lacombe, Alta.

Surveys have been made and preliminary arrangements are being made by Lacombe & Blindman Valley Electric Railway Company for construction of electric railway to connect Lacombe,

CEMENT - GUN



GUNITE PARTITIONS BUILT BY LARGE CANADIAN WATER POWER COMPANY (Interior Work)

Gunite partitions, interior or exterior, occupy less space and are stronger than any other types of equal thickness. They cannot be easily defaced. The illustrations shown herewith are examples of the use of the ***Cement-Gun*** on this class of work.

Our new 107-page monograph on the **Cement-Gun** embraces the **Process, Product, Apparatus, General Data, Uses** and **Opinions.** A copy of this illustrated treatise will be mailed upon request to every Engineer, Contractor and other parties who are interested in concreting. **Write for your free copy NOW.**

PARTITION WALL SEWAGE DISPOSAL PLANT, FITCHBURG, MASS
Built of Gunite (Exterior Work)

Cement - Gun
Company
Incorporated
New York, N. Y.
30 Church Street

Tenders and For Sale Department

City of St. Catharines, Ont.

Tenders for Concrete Bridge Construction

Sealed tenders for the erection of the substructure of the St. Paul Street High Level Bridge, addressed to the City Clerk, will be received until five o'clock p.m. on the **15th** day of October, **1914**.

Principal Items of Work

Excavations	3000 cu. yds.
Concrete masonry in abutments	1850 cu. yds.
Concrete masonry in copings	65 cu. yds.
Timber piles	10240 lin. ft.
Anchor Bolts	7250 lbs.
Steel reinforcement	3600 lbs.

Information for tenderers, plans and specifications may be obtained at the office of the City Engineer, St. Catharines, Ont., on the receipt of a deposit of Five Dollars which will be refunded on receipt of a bona fide tender.

A certified cheque in the amount of $3,000, payable to the City Treasurer, is required to be deposited with the bid, and a construction bond of $10,000 shall be furnished the City by the tenderer to whom the contract is awarded.

The City reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the City.

W. P. NEAR,
City Engineer.

39-40

Temiskaming & Northern Ontario Railway Commission

Tenders for Restaurant Privileges

Sealed tenders (which must be separate for each restaurant) addressed to the undersigned and endorsed "Tender for Restaurant Privileges," will be received at the office of the Commission, 25 Toronto Street, Toronto, up to 12 o'clock noon on **Thursday, the 22nd day of October, 1914**, for the restaurant privileges for five years at each of the following places, (such privileges to become effective from the dates hereinafter [illegible]

Timagami from February 10th, 1915.

Englehart from November 1st, 1914.

Cochrane, when open.

Each tender must be accompanied by an accepted cheque upon a chartered bank of Canada payable to the order of the Commission for ten per cent. of the amount of such tender.

The restaurants at Englehart and Cochrane will be heated by the Commission but at Timagami the party whose tender is accepted will be required to furnish the necessary heating.

In the case of each restaurant the party whose tender is accepted will be required to promptly execute a lease in form satisfactory to the Commission, failing which his cheque will be absolutely forfeited to the Commission and if deemed necessary, by the Commission, he shall also furnish a bond satisfactory to the Commission for the due performance of such lease.

The cheques sent in by unsuccessful tenderers will be returned to them.

The Commission does not bind itself to accept the highest or any tender.

For further particulars apply to the undersigned.

Dated at Toronto this 1st day of October, A. D. 1914.

A. J. McGEE,
Secretary-Treasurer.

40-41

Sealed tenders addressed to the undersigned and endorsed "Tender for Boilers C. G. S. 'Tyrian,'" will be received at this office until 4 p.m. on **Friday, October 9, 1914**, for the construction and delivery of two single ended Scotch Boilers **11** feet 6 inches diameter by 10 feet 6 inches long, for a working pressure of **130** lbs. per square inch, delivered at Halifax, N.S., on the wharf next I. C. R. Terminal for a fixed sum.

Plans, specifications and form of contract can be seen and forms of tender obtained at the Department and at the offices of the Dictrict Engineers at Toronto, Ont., Shaughnessy Building, Montreal, P.Q., St. John, N.B., and at the office of Mr. A. B. Crosby, Halifax, N.S.

Persons tendering are notified that tenders will not be considered unless made on the forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Ministtr of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 25, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.

39-40

Sales Agents Wanted

Large United States chain manufacturers now represented in Quebec Province want to secure Sales Agents in Ontario, Western Canada and Maritime Provinces for all kinds of logging chain, dredging chain, etc. Apply Box 78, Contract Record, Toronto, Canada. 39-41

CAPITAL introduced for sound enterprises of all kinds. 5 per cent. commission. Bond and stock issues placed. Underwriting procured. References exchanged. Address Cooke & Byrne, Harcourt Street, Dublin, Ireland. 40-45

Sealed tenders addressed to the undersigned and endorsed "Tender for Engines C. G. S. 'Tyrian,'" will be received at this office until **4** p.m., on **Friday, October 9, 1914**, for one set of inverted fore and aft compound surface condensing engines, cylinders about **20** and **42** inches diameter by **27** inches stroke for **130** lbs. working pressure, delivered at Halifax, N.S., on the wharf next I. C. R. Terminal for a fixed sum.

Specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers at Toronto, Ont., Shaughnessy Building, Montreal, P.Q., St. John, N.B., and at the office of Mr. A. B. Crosby, Halifax, N.S.

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Department of Public Works,
Ottawa, September 25, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 39-40

Late News Items

(Continued from page 64)

Bentley and Rimbey. J. C. Gibson, 56 King Street West, Toronto, is president.

Moncton, N.B.

Freight Shed owned by Dominion Government, Department Railways and Canals, was damaged to extent of $15,000 by fire. Owner will probably rebuild. L. K. Jones, Ottawa, is Minister of Department.

Ottawa, Ont.

Board of Control has awarded contract for construction of four concrete piers and two abutments for substructure of Billings Bridge to Thomas Brewder, Lyons Street, Ottawa. The contract for superstructure of Billings Bridge has been awarded to Dominion Bridge Company, Limited, Montreal, Que., at $32,784 for the steel, and $9,990 for the erection.

The building permit for new Customs House being erected on Sussex Street places estimate of cost at $1,173,000. Foundation work exceedingly difficult and cost over $500,000.

Peterboro, Ont.

The Peterboro Radial Railway Company is considering plans for reconstruction of its electric railway on Charlotte Street. W. H. Munro, Peterboro, is local manager.

Quebec, Que.

City Council has decided to build boiler room on Beauport Road, estimated to cost $150,000. Building will be brick and steel. J. L. Pinsonnault, City Hall, is architect.

In connection with construction of $5,000 Residence for A. Demars, 126 Des Stigmatis, owner is receiving tenders for plastering and painting material. Building will be three-storey, 30 by 40 ft., brick and frame.

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a** quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

347 Adelaide Street West, Toronto

Residence of Ralph Peters, Esq., President, Long Island R.R.
Aymar Embury II, Architect, New York.

Shingles stained with Cabot's Shingle Stains, stucco stained with Cabot's Waterproof Cement Stains, and lined with Cabot's Quilt, for warmth.

CABOT'S CREOSOTE SHINGLE STAINS

The Standard Stains for Shingles, Siding or Trimmings. The first shingle-stain ever made and quality guaranteed by thirty years' use. Made of the strongest and finest colors, ground in pure linseed oil, and Creosote, "the best wood preservative known," No cheapeners, no adulterations, no kerosene or benzine.

CABOT'S "QUILT"

The warmest lining. Heat-proof. Cold-proof. Sound-proof. Uninflammable, non-decaying, vermin-proof. Insulates cold-storage and ice-houses, and all other buildings. Deadens sound in floors and partitions.

Cabot's Waterproof Cement and Brick Stains

For waterproofing and tinting stucco and similar cement surfaces, and for freshening, restoring and waterproofing bricks.

Cabot's Conservo Wood Preservative

For preserving ties, poles, planking and all other lumber.

Cabot's Plasterbond Damp-proofing

For direct plastering on brick or concrete without studding or lathing. Forms a perfect permanent and impervious bond.

Cabot's Mortar Colors

Strongest, finest and most lasting.
Send for Samples and Prices.

SAMUEL CABOT, Inc., Mfg. Chemists, Boston, Mass.

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Saskatchewan Supply Co., Saskatoon.
Braid & McCurdy, Winnipeg.
Seymour & Co., Montreal.
Can. Equipment & Supply Co., Calgary and Edmonton.
F. A. Gillis & Company, Halifax and Sydney.

PURE WATER

It is easy to obtain with our plants and apparatus

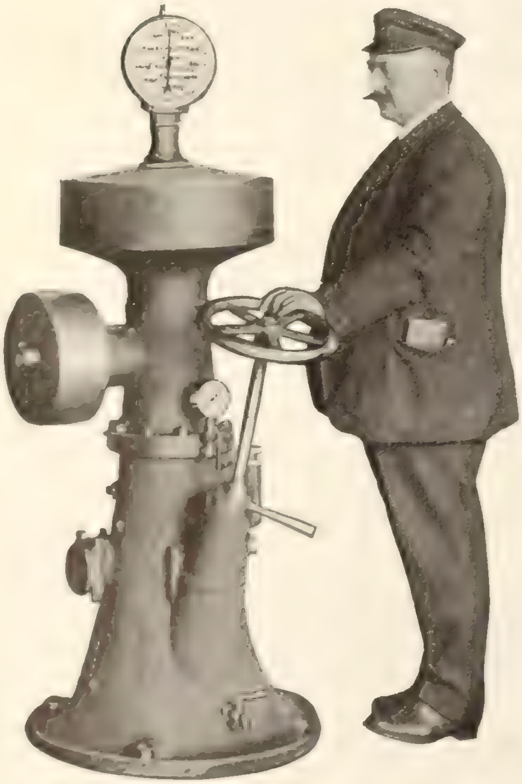
We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

Literature, Sketches, Estimates and Recommendations Supplied on Request

American Water Softener Co.
1001 Chestnut St., PHILADELPHIA, Pa.

We have no affiliations or working acquirements with any of our competitors.



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FOR SALE

One —55 Ton Switching Engine
One —35 Ton Vulcan Dinkey
Three—25 Ton 12 x 18 American Locomotive Co. Dinkies
Three—25 Ton 12 x 18 Vulcan Dinkies
Five —25 Ton Porter Dinkies
Two —10 x 16 Standard Gauge Vulcan Dinkies
One —10 x 16 36″ Gauge Porter Dinkey
Eighty—6 Yard K. & J. Dump Cars
Twenty—6 Yard Continental Dump Cars
Ten —4 Yd. Continental Dump Cars, 36″ gauge
Two Model 60 Marion Shovels
One —75 Ton Marion Shovel with extra high lift Boom
Two —Stone Crushers

Motors, all sizes, from 15 to 200 H.P., 3 phase, 440 volts to 2200 volts.

W. FRASER,
83 Craig St. W. MONTREAL

Keith Fans

The opportunity for greater economy and efficiency in **Heating and Ventilating** is emphasized in the **"Keith" Fan.** Comparative tests of other types of fans have resulted in the **"Keith"** being proclaimed the most efficient and economical in the Fan World. Write for our New Catalogue No. 55.

SHELDONS LIMITED, Galt., Ont.

Toronto Office: 609 Kent Building

AGENTS :
Messrs. ROSS & GREIG, 412 James St., Montreal, Que.
Messrs. WALKER'S LTD., 259-261 Stanley St., Winnipeg, Man.
Messrs. GORMAN, CLANCEY & GRINDLEY, LTD., Calgary and Edmonton, Alta.
Messrs. ROBERT HAMILTON & CO., LTD., Bank of Ottawa Bldg., Vancouver, B. C.

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $70 to $140; tapestry brick, $20 to $30; sand lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$4.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 65c.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals). Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; Bsitish manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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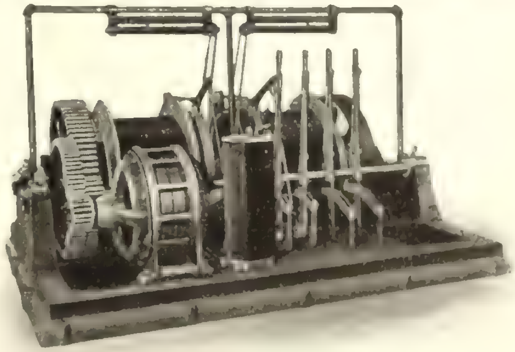

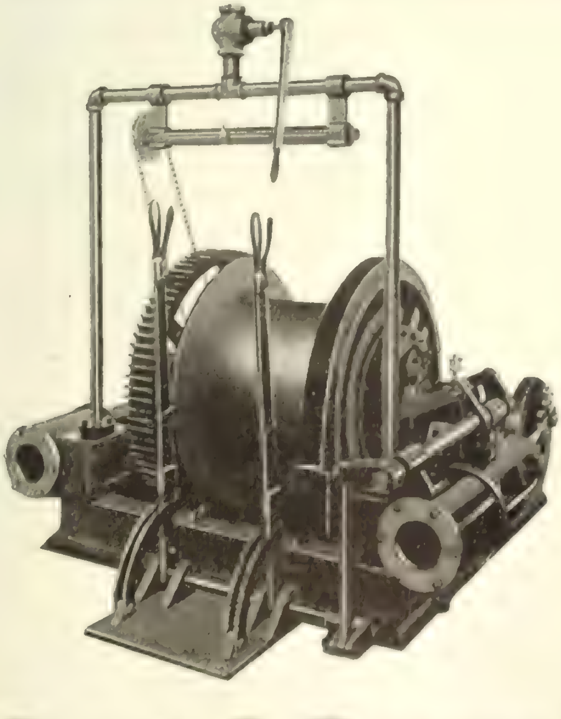

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Steam and Electric
for all purposes

Cut gears are standard on all sizes and assure quiet running and high efficiency.

Ordinary sizes may be shipped from stock.

Rock & Power Machinery, Limited

HEAD OFFICE:—12 King Street, East, Toronto

BRANCH OFFICES: Halifax Sudbury Cobalt Vancouver
and in the King Edward Hotel, Toronto

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 70)

Dimension Timber (No. 1 pine, spruce, tamarac [illegible])—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, [illegible]

Pine—1 in. common, 6 to 10 in., $105; 12 in., $110; [illegible] 4-in. casing, $3.70 per 100 ft., 5 in. ditto, $4.40; 8-in. pine base, $6; 10 in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.50 per 100 lbs.; boiled linseed oil, in bbls., 73 cents per gal.; raw linseed oil, in bbls., 70 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

STEEL & RADIATION LIMITED
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"TAMCO" Crushed Stone in all sizes, for all purposes. "Roman" building stone. "Milton" pressed bricks. Sanitary flooring, stone crushers, fire engines, &c.
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Flexible and Flange Pipe,
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CAST IRON PIPE

3 inches to 60 inches diameter
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Bare and Insulated Electrical Wires for all purposes.

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Prompt shipments from Factory or nearest warehouse.

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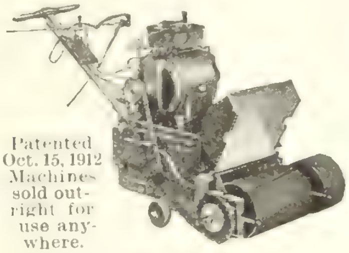
FREE TRIAL OFFER

Made in several sizes for small rooms or large areas. Let us send you the names and addresses of Canadian owners near you.



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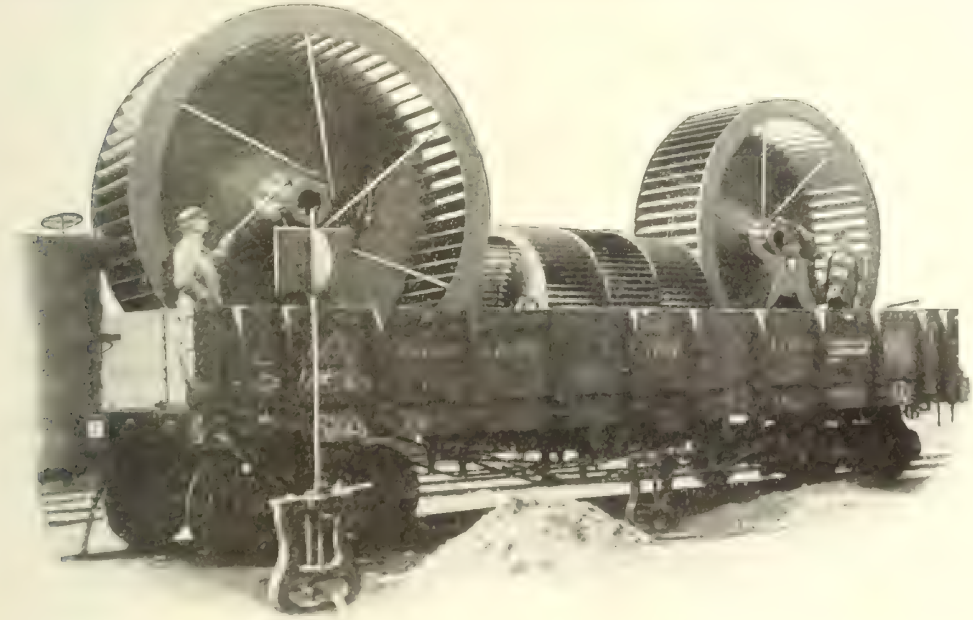

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Patented Multi-Blade Fans and Blowers

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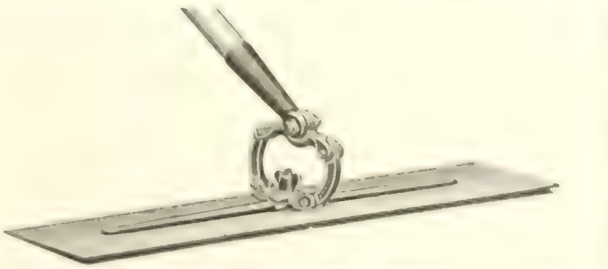

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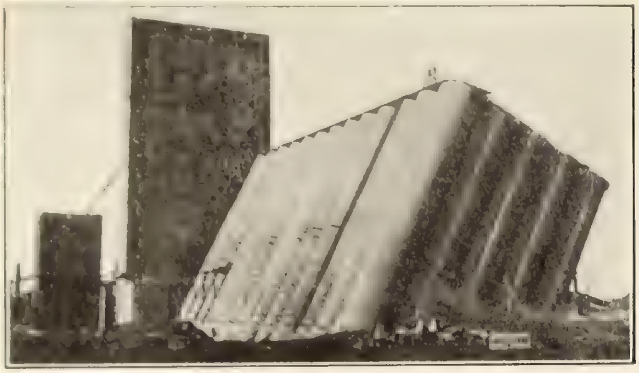

NOTICE

The building in the illustration, built of concrete, was righted to its proper position without damage to structure.

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was used on the entire contract.

Strongly Built **Easy to Operate** **Complete Control**

MARSH and HENTHORN, LIMITED, Belleville, Ont.

Designers and Builders Hoisting Machinery

Sales Agents: MUSSENS, LIMITED, Montreal, Que.

HERRINGBONE COPPER ALLOY LATH

Why Copper Alloy?

All Herringbone lath is now made from copper alloy instead of ordinary steel. This change costs the manufacturers and dealers in Herringbone Copper Alloy Lath thousands of dollars a year. It costs the consumers nothing.

The group of business men interested in promoting Herringbone sales expect the increase in the volume of business to compensate them for the decreased profit per yard. This increase can only result from a definite improvement in Herringbone quality. They therefore demanded the most searching tests before adopting the new policy.

These tests consisted of seventy-five quantitative measurements of actual corrosion of plain steel bedded in hard wall plaster as compared with seventy-five identical tests on copper alloy. Five different brands of plaster were used. The time tests were continued until corrosion on copper alloy (but not on plain steel) had ceased. The average of all these tests showed that copper alloy is sixty-one per cent. more efficient than plain steel in resisting hard wall plaster corrosion. Ask for the booklet "Why Copper Alloy?"

Clarence W. Noble - General Sales Agent

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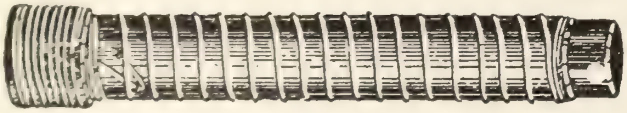
Metal Shingle & Siding Company, Manufacturers



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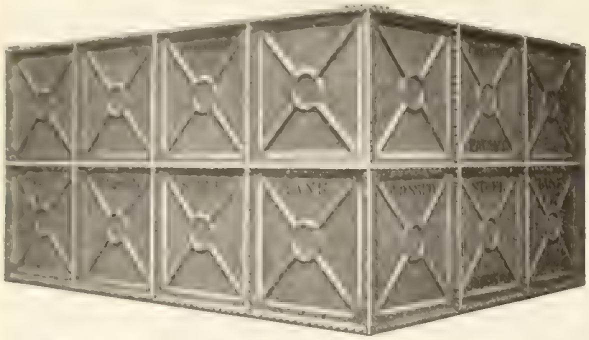

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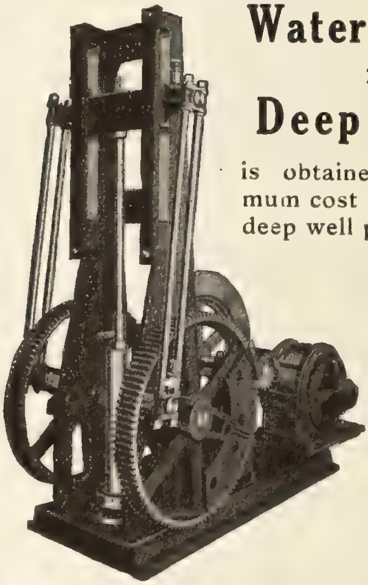

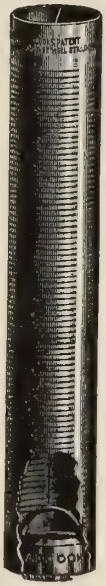

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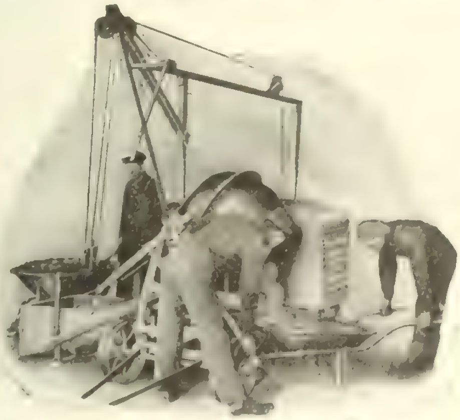

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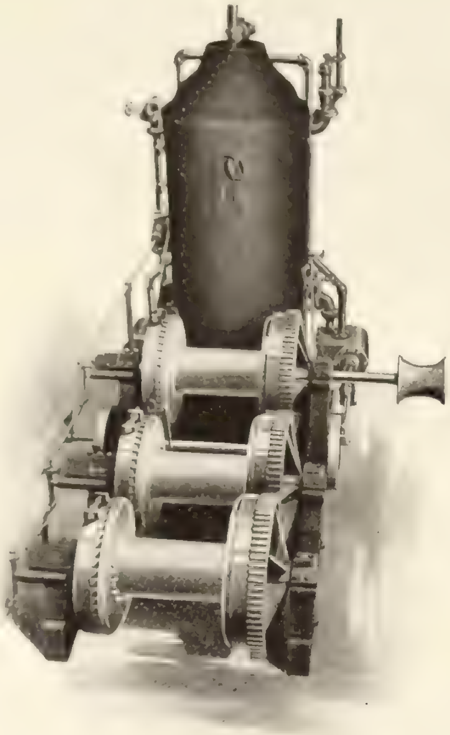

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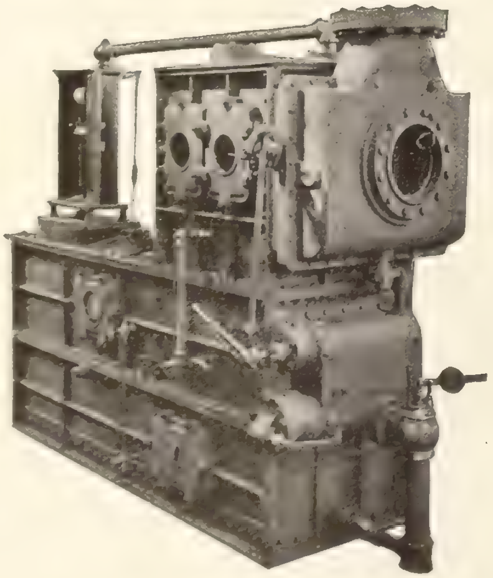

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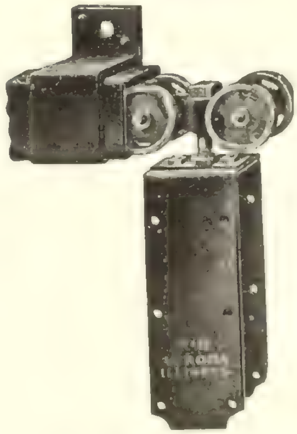

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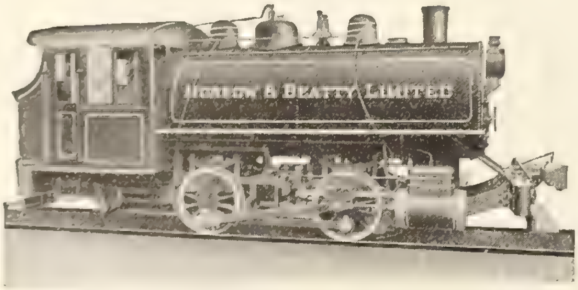

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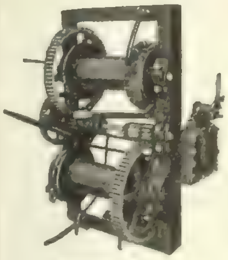
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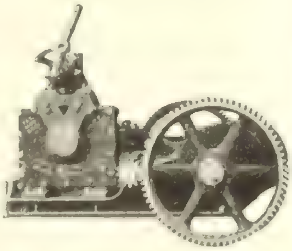
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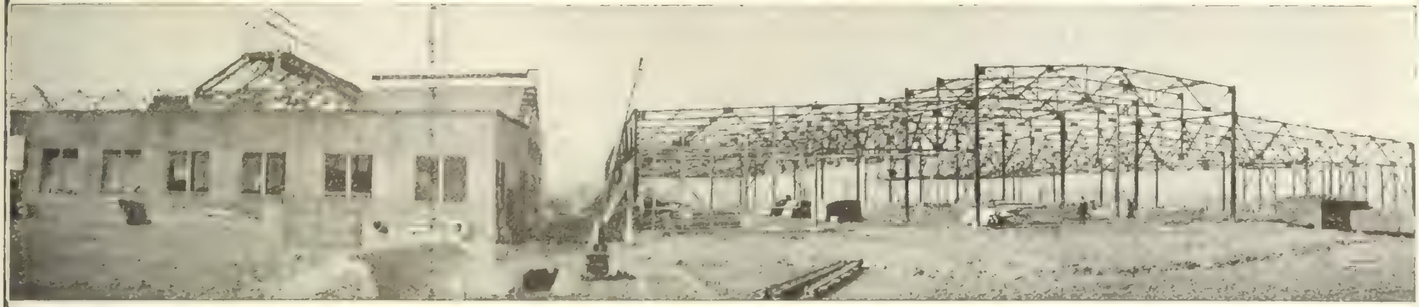

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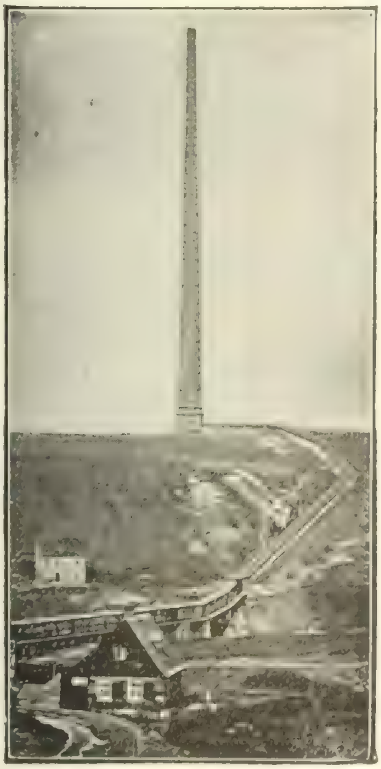

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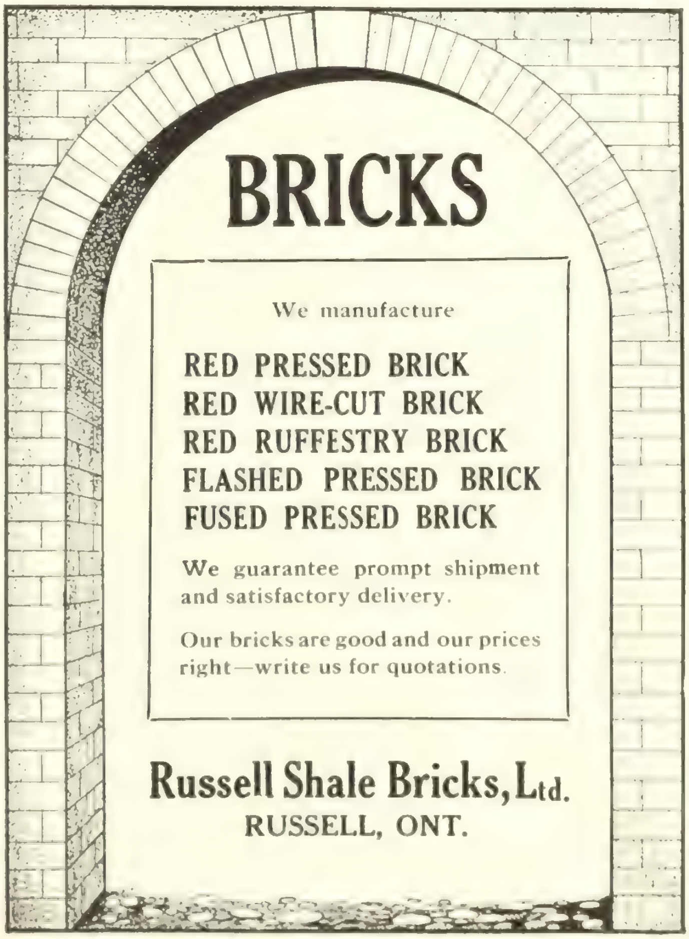

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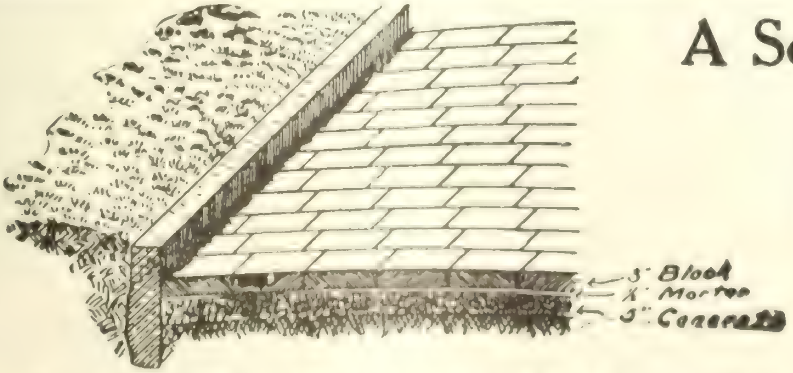

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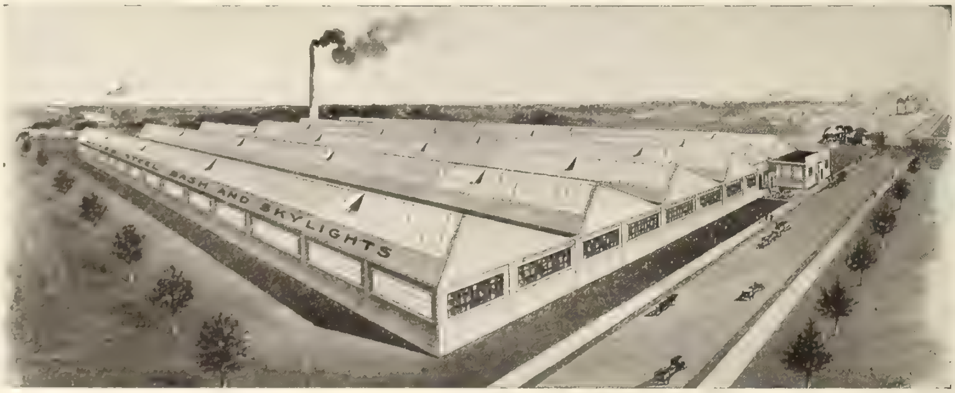

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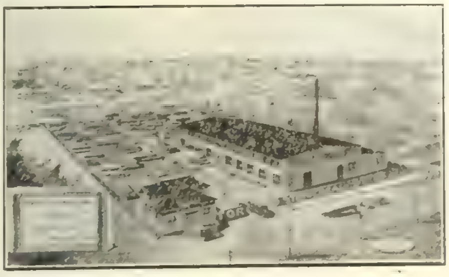

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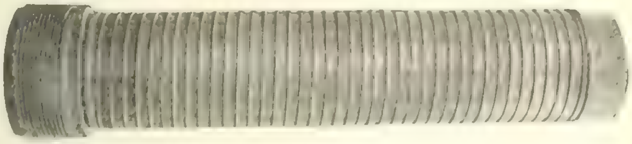

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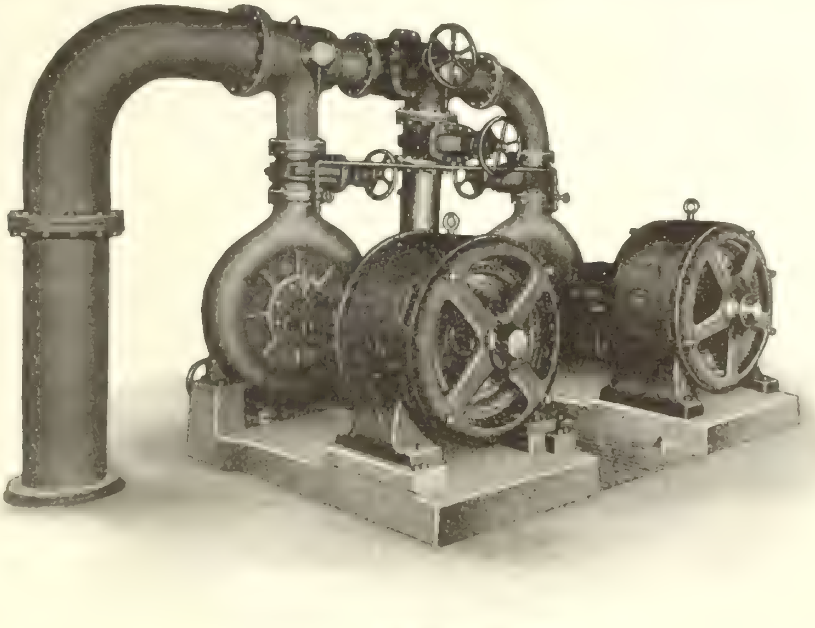

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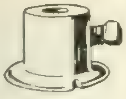

Fig. 1

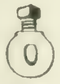

Fig. 2

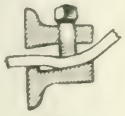

Fig. 3

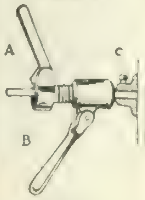

Fig. 4

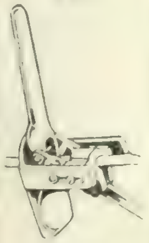

Fig. 5

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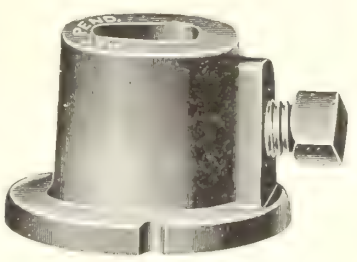

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Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

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Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

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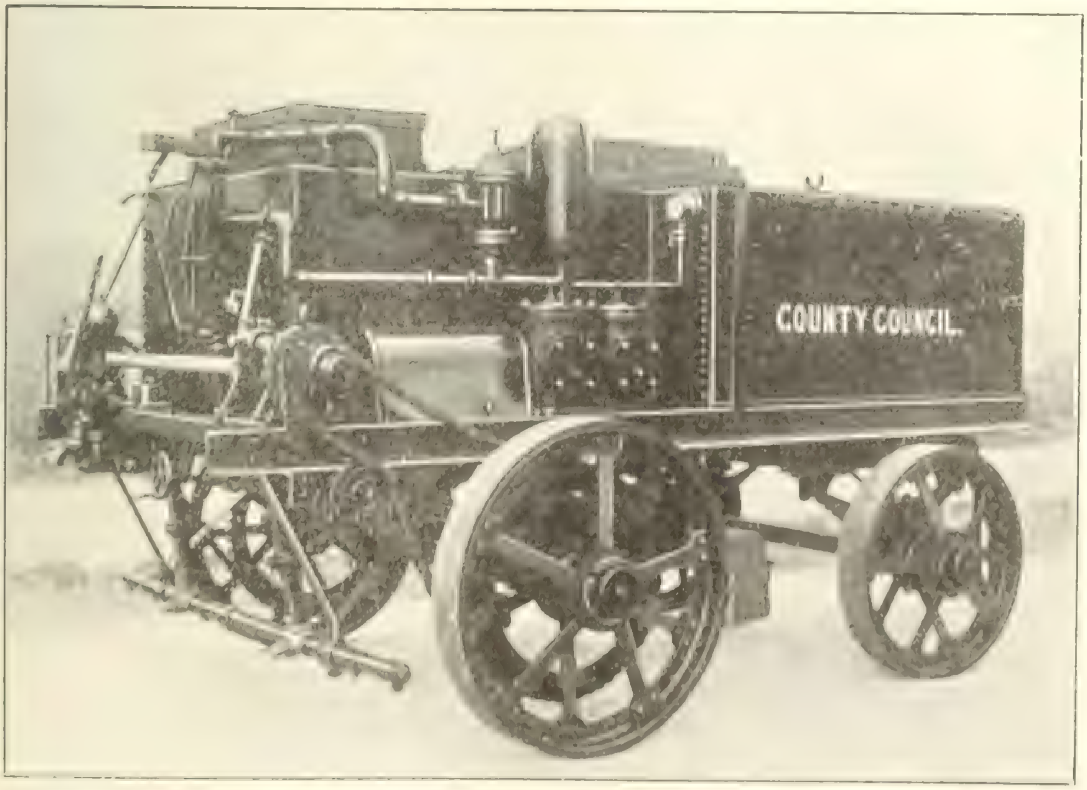

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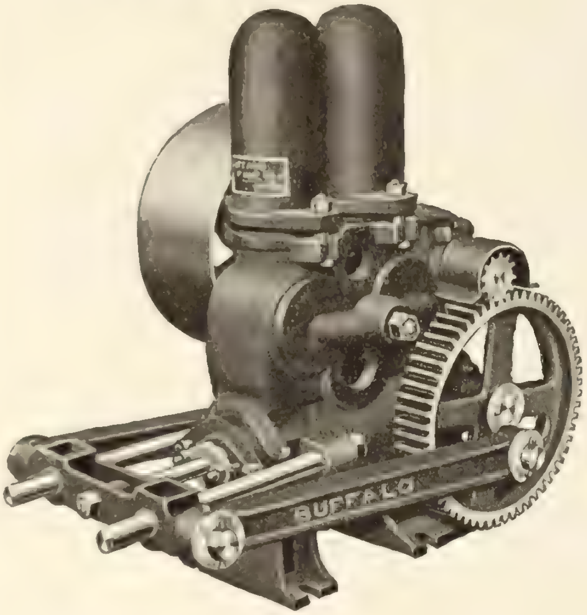

Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

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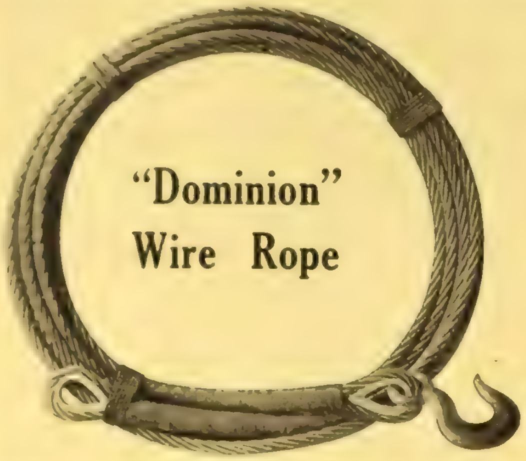

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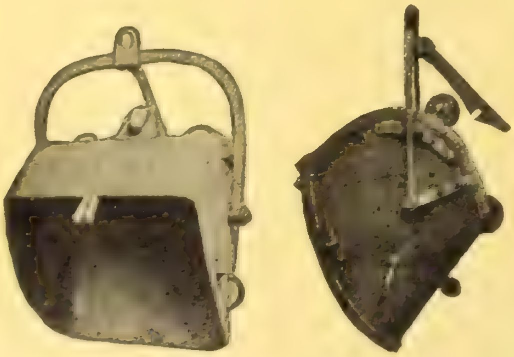

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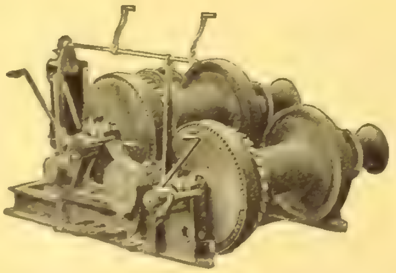

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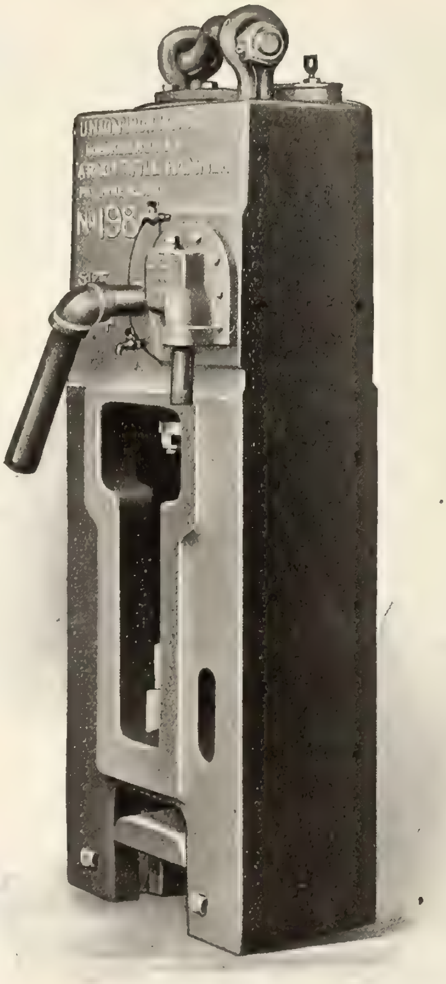

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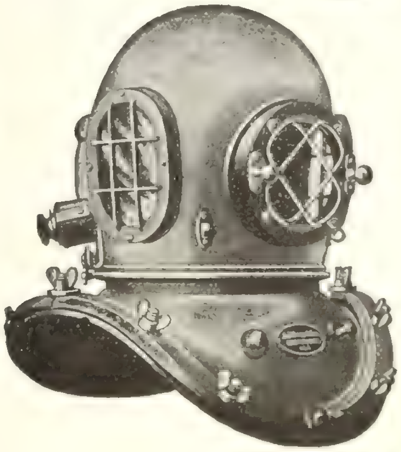

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Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Mills Bros.
Morris Machine Works
Municipal Engineering & Contracting Co.
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Mussens Limited
Radigan Company, John
Railway Contractors Supply Co.
Royce Limited
Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Co.
Tiffin Wagon Works

Controlling Altitude Valves
Golden Anderson Valve Co.

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Conduits Co., Limited
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
Sudbury Construction & Machinery Company

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Sturtevant Co. of Can., Ltd., B. F.
Sutcliffe, Speakman & Co.

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Pedlar People Limited
Sarnia Metal Products Company

Crank Shafts
Canadian Billings & Spencer

Cranes, Travelling and Locomotive
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert
Northern Crane Works
Rock & Power Machinery, Ltd.
Roelofson Elevator Works
Royce Limited

Creosote Stains
Cabot, Inc., Samuel

Crushed Stone and Granite
Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
Smyth & Ryan

Crushers (Stone and Rock)
Canadian Allis-Chalmers, Ltd.
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Jenckes Machine Co.
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London Concrete Machinery Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.

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Pedlar People
Sarnia Metal Products Company

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Mannesmann Tube Company

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Hepburn, John T.

Dredges
Beatty & Sons, M.
Browning Company
Morris Machine Works

Drills
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Head Office and Works

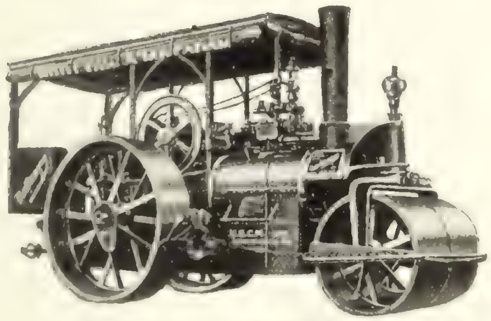
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



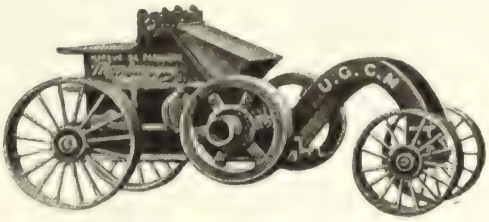
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

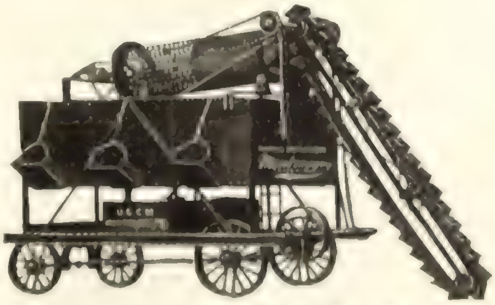
A great feature
"Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Portable Steel Bin.

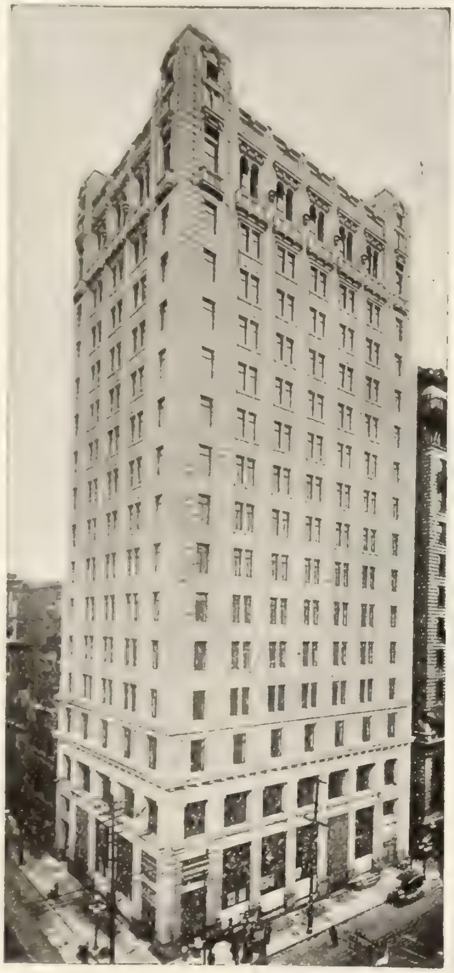
Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable The Elevator is all-steel and double chain.

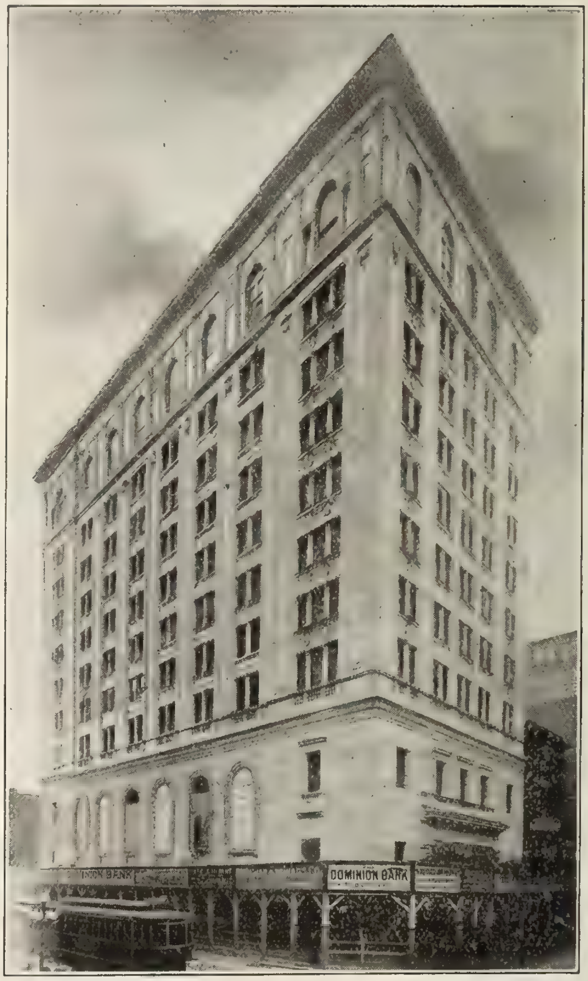
General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pierson, Architects



DOMINION BANK BUILDING
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Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

A Stitch in Time Saves Nine

(Old Proverb)

And Ceresit used in constructing the basement of a building will eliminate all possibility of leakage in the future.

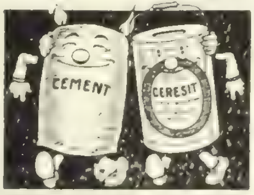
But if Ceresit has not been used and the basement does prove damp and unusable, it is a comparatively easy matter to remedy it by applying a plaster coating of Ceresitized Cement Mortar to the inside of walls and floor.

CERESIT TRADE MARK

Ceresit is equally effective either in preventing future leakage or remedying present conditions of leakage. It is the only waterproofing for cement that gives protection against both dampness and hydrostatic pressure.

Write for the "Book of Evidence."
It tells the complete facts.

TWO GOOD THINGS TO USE



THEY GO WELL TOGETHER

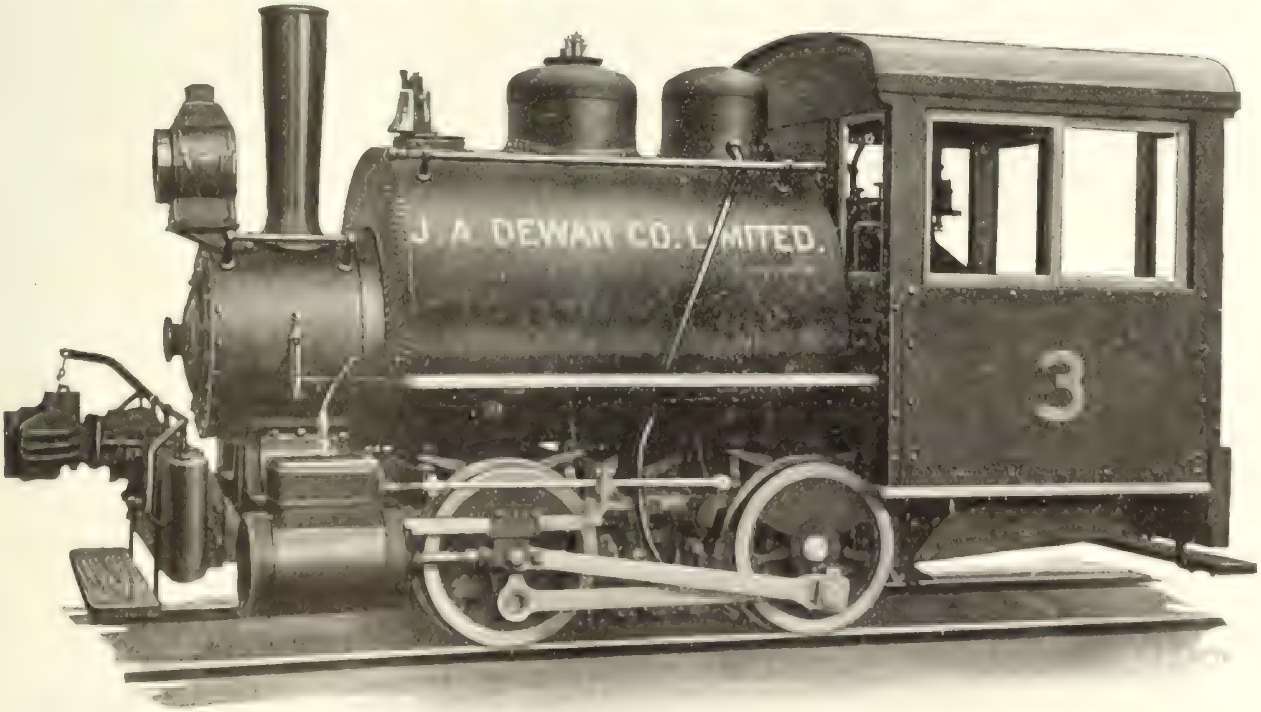
Ceresit Waterproofing Co.

913 Westminster Building, - - CHICAGO, ILL.

FACTORIES—Chicago, Unna, Germany, London, Paris, Vienna, Warsaw.

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta; E. C. Cullen, Vancouver, B.C.; Walker's Ltd., Winnipeg, Man.; R. de B. Carrite, St. John, N.B.; W. K. Macdonald Co., Toronto, Ont.; McLellan Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; Mackenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.

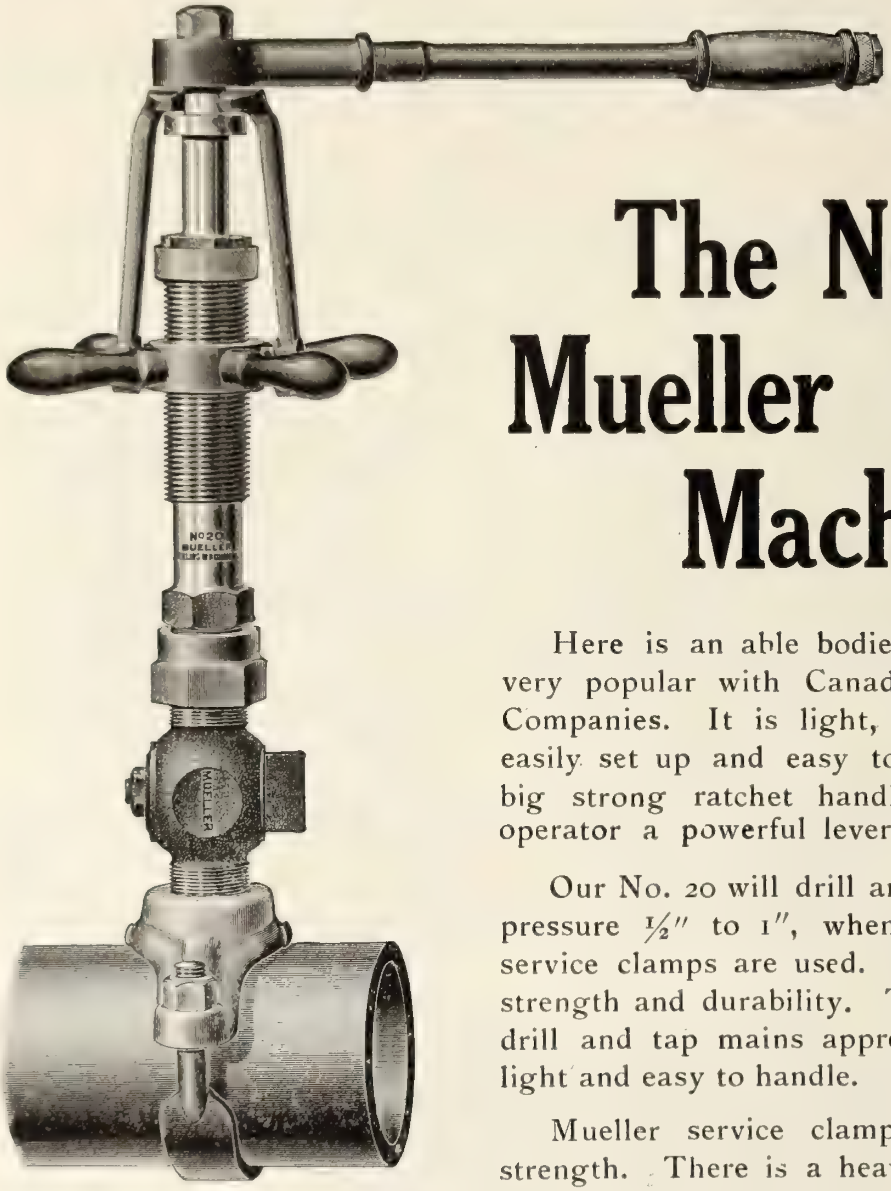
CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG



The No. 20 Mueller Drilling Machine

Here is an able bodied little tool which is very popular with Canadian Gas and Water Companies. It is light, strong and compact, easily set up and easy to operate. Note the big strong ratchet handle which affords the operator a powerful leverage.

Our No. 20 will drill any size pipe under any pressure ½″ to 1″, when Mueller cocks and service clamps are used. It is a little giant in strength and durability. The men who have to drill and tap mains appreciate it because it is light and easy to handle.

Mueller service clamps are unexcelled in strength. There is a heavy boss and a rib to give them extra strength. They are made to fit the surface of the pipe with a groove on the under side for a lead ring gasket, which insures a tight joint. The straps are soft, forged steel with true threads.

This combination will give you good service and make your work easy.

Clip and mail the coupon.

C. R.

**H.
Mueller
Mfg. Co.
Ltd.
Sarnia, Ont.**

Send me your Catalog D with prices on No 20 Mueller Machine.

Signed ....

City.................. *Prov*..................

"Made in Sarnia"

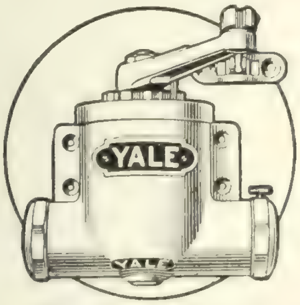
H. Mueller Mfg. Co., Ltd.
SARNIA, ONTARIO
Makers of High Grade, Water and Gas Brass Goods

YALE

"The Mark of Quality and Efficiency"

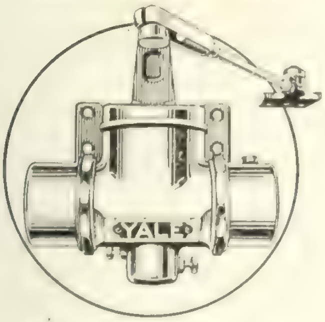
Door-Closing Devices

Back of every Yale Door-Closing Device stands the Yale guarantee for quality, performance and durability. Any responsible hardware dealer can supply you with Yale Door Closers. To convince you of their ability to live up to the Yale name, your dealer can supply one on 30 days' trial without obligation to you. Write for booklet "Quiet and Comfort."



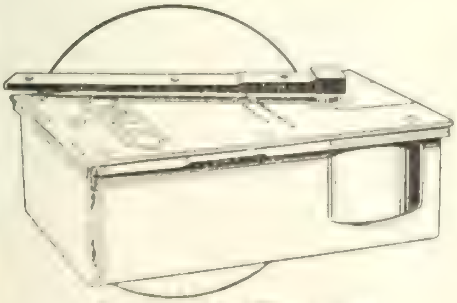
Single-Acting Door Closer

Insures noiseless closing doors. Fits any door. Made in five sizes. Positive in action.



Double-Acting Door Closer

Similar to the Single Acting Door Closer but intended for doors that swing in both directions.



Yale Checking Floor Hinge

Perform same functions as the Yale Door Closers but is placed on the floor beneath the door.

Canadian Yale & Towne Limited

Makers of Yale Products in Canada

Locks, Padlocks, Builders' Hardware and Door Closers

General Offices and Works:

ST. CATHARINES, ONT.

"Made in Canada" "Made in Canada"

Now is the time to get ready for a big fall business. It will be big, not because we all "psychologically" hope it will be, but because no man can stop it.

We are making the line of NEPONSET Waterproof Building Products better and better every day.

The GRANITIZED Shingle is our greatest and latest roofing development—have you seen a roof yet?

NEPONSET Paroid and Proslate—the standard of ready roofings.

NEPONSET Wall Board is being used more and more in all sorts of new and old construction.

TEAR OFF the coupon and ask for information in regard to any of the following:

NEPONSET
WALL BOARD
FOR WALLS AND CEILINGS

Waterproof Building Papers — Paint

Roofings, (Paroid, Proslate)

Deadening Felt — Wallboard

Granitized Shingles

We are ready for the big business—Are you?

BIRD & SON

MAIN OFFICE:
23 Heinzman Bldg., Hamilton, Ont

MILLS:
Hamilton, Ont., and Pont Rouge, Que

WINNIPEG, MAN. ST. JOHN, N. B
MONTREAL, QUE VANCOUVER, B C

Bird & Son, East Walpole, Mass.

Please send me information in regard to

"Made in Canada" "Made in Canada"

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  Canadian Billings & Spencer, Ltd.

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  Manitoba Bridge & Iron Works
  Schell Foundry & Machine Co.
  Sheldons Limited

Dump Carts and Wagons
  Deere Plow Co., John
  McNally & Co., Wm.
  Troy Wagon Works

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  Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
  Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
  Gent & Company

Electric Steel Castings
  Electric Steel & Metals Co.

Electrical Supplies
  Northern Electric Company

Elevators
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  Roelofson Elevator Works
  Turnbull Elevator Co.

Enamelled Brick
  American Enamelled Brick & Tile Company

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  Canadian Buffalo Forge Co.
  Canadian Sirocco Company
  Inglis Company, John
  Jenckes Machine Company
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Rock & Power Machinery

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  Bowman & Connor
  Campbell, R.
  Cape Company, E. G. M.
  Chipman & Power.
  Dominion Engineering & Inspection Company
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  Galt Engineering Co., John
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  Mitchell, C. H.
  McDougall, Geo. K.
  Pullar, H. B.
  Tyrrell, H. G.

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  Municipal Engineering & Contracting Company
  Parsons Company, G. W.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expanded Metal
  Pedlar People Limited

Fans
  Canadian Sirocco Company
  Sheldons Limited
  Sturtevant Co. of Can., Ltd., B. F.

Fuel Economizers
  Sturtevant Co. of Can., Ltd., B. F.

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  Ferranti Electrical Co.

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  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Filtration Plants
  verMehr Engineering Co., John.

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  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry
  Mussens Limited
  Pedlar People Limited
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Company

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  Wayvell Chappell & Co.

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
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  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

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  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.

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  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.
  Mills Bros.

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  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co.

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  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Pittsburgh Valve, Foundry & Construction Company

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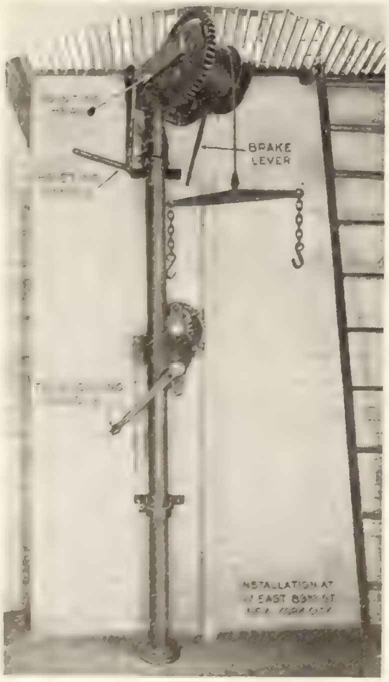
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock and Power Machinery
  Royce Limited

(Continued on Page 14)

G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.

2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.

3.—Simple in construction and absolutely rigid when erected.

4.—It is made of strongest and most durable material.

5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.

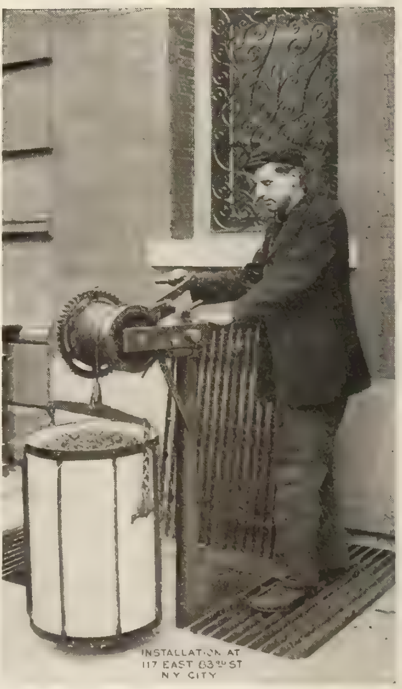
6.—A powerful ratchet device is provided with both handles above mentioned.

7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan

549 West Broadway
New York



Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

W. T. Grose
Agents for Manitoba, Saskatchewan, Alberta
Winnipeg

Wm. N. O'Neil Co., Ltd.
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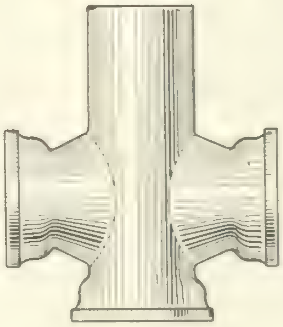
Vancouver

Warren

Cast
Iron
Pipe



Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

Large stocks always carried on hand.
Prompt shipments.

Warren Foundry
and Machine Co.
11 Broadway - NEW YORK

The Hauling Problem—and the Solution
Western Dump Wagons

You can do more hauling with fewer teams. Western Dump Wagons are built strong and compact. Have ample opening for discharge of load. They stay on the road working for you. Others have increased their profits. Let us tell you how you can.

Catalog upon request.

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
AURORA, ILLINOIS
Dominion Equipment & Supply Co., Winnipeg, Calgary, Edmonton
Agents for Manitoba, Saskatchewan and Alberta
Canadian Equipment Co., Montreal, Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F.

Hoists
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- Goold, Shapley & Muir Co.
- Roelofson Elevator Works
- Northern Crane Works

Hoisting Engines
- Beatty & Sons, M.
- Canadian Allis-Chalmers, Ltd.

Hydrants
- Canada Iron Corporation
- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

Industrial Cars
- Central Locomotive & Car Works

Insulating Compounds
- Standard Underground Cable Co. of Canada, Limited

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- Canada Office & School Fur. Co.
- Rhodes Curry & Company

Jib Cranes (all kinds)
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert

Kilns
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Sturtevant Co. of Can. Ltd., B. F.
- Canadian Sirocco Company

Kyanized Spruce
- Berlin Mills Company

Lime
- Dominion Lime Company
- Jamieson Lime Company
- Ontario Lime Company, Ltd.
- Standard White Lime Co.

Lighting and Pumping Installations
- Lister & Co., Ltd., R. A.

Locks
- Can. Yale & Towne Ltd.

Locomotives
- Boving Company of Canada
- Central Locomotive & Car Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
- Montreal Locomotive Works
- F. H. Hopkins Company
- Mussens Limited

Metal Lath
- Greening Wire Co., B.
- Metallic Roofing Co.
- Noble, C. W.
- Pedlar People Limited.
- Steel & Radiation Ltd.

Metallic Roofing
- Sarnia Metal Products Co.

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- Ferranti Electrical Mfg. Co.
- Canadian Allis-Chalmers, Ltd.

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- Sturtevant Co. of Can. Ltd. B. F.

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- Hopkins & Co., F. H.
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- Neptune Meter Co.

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- Brown Hoisting Machinery Co.
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- Dominion Paint Works
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- Asphalt & Supply Co.
- Aztec Oil Asphalt Co.
- Bessemer Limestone Co.
- Baker Co., R. D.
- Barber Asphalt Paving Co.
- Dunn Wire-Cut-Lug Brick Co.
- Ontario Asphalt Block Co.
- Paterson Mfg. Co., B.

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- American Spiral Pipe Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Pipe Co.
- Dominion Concrete Co.
- Gartshore-Thomson Pipe Co.
- National Concrete Mfg. Co.
- National Iron Works
- National Pipe & Foundry Co.
- Pacific Coast Pipe Co.
- Piggott & Co., Thos.
- United States Cast Iron Pipe Co.
- Vancouver Wood Pipe & Tank Company.
- Walsh Plate & Structural Works.
- Warren Foundry & Machine Co.

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- Springer, O. T.

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- Dominion Paint Works

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- Greening Wire Co., B.

Pipe Machinery
- Sutcliffe, Speakman & Co.

Pile Driving Machinery
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Ingersoll-Rand Co.
- Lecky & Collis

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- Pittsburgh Valve, Foundry & Construction Company

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- Mueller Mfg. Co., H.

Planing Mill Exhausters
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.
- Sturtevant Co. of Can., Ltd., B. F.

Plaster
- Albert Mfg. Company
- Britnell & Company
- Ontario Lime Co., Ltd.

Plate Glass
- Excelsior Plate Glass Co.
- Pilkington Bros.

(Continued on page 16)

Sarnia - Keystone Copper Bearing Galvanized

Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron
Plain Black Iron
Galvanized Iron

V-Crimped Roofing
Metal Siding
Valleys

Conductor Pipe
Eave Troughs
Culverts

Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

Sarnia Metal Products Company, Limited

Sarnia, Canada

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

"SUPERIOR GRAPHITE PAINT"

ON

BRIDGES

MEANS

PROTECTION

ITS USE INSURES these costly structures AGAINST CORROSION

"Superior Graphite Paint" is unaffected by the weather, gases, or brine drippings.

Special Coatings Made for Salt Water Exposures

The use of "Superior Graphite Paint" and the Special Protective Bridge Coatings made by this Company has steadily increased, and their use by the leading railways and municipalities is a guarantee of their quality.

Write for full particulars to

DOMINION PAINT WORKS, LIMITED

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Toronto

WALKERVILLE, ONT.

Winnipeg
Vancouver

Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich

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Honig & Mock.
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Laurie Company, E.
McDougall Caledonian Iron Wks.
Morris Machine Works.
Smart-Turner Machine Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Rock & Power Machinery

Portable Track
Bechtels Limited

Pulleys
Sutcliffe, Speakman & Co.

Plug Drillers
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Power Engines
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Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.

Quarry Machinery
Canadian Allis-Chalmers, Ltd.
Canadian Ingersoll-Rand Co.
Jenckes Machine Company
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company
Rock & Power Machinery, Ltd.

Railway Supplies
Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Reinforcements, Concrete & Steel
Brown Hoisting Machinery Co.
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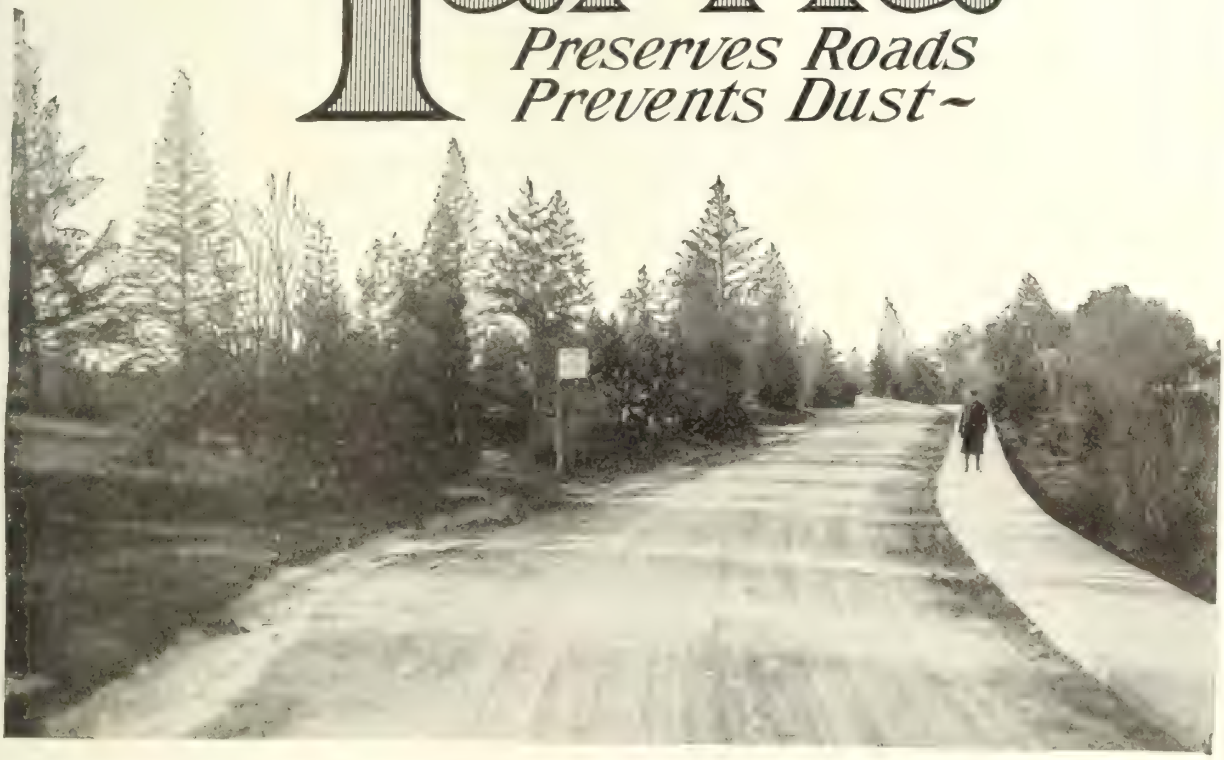

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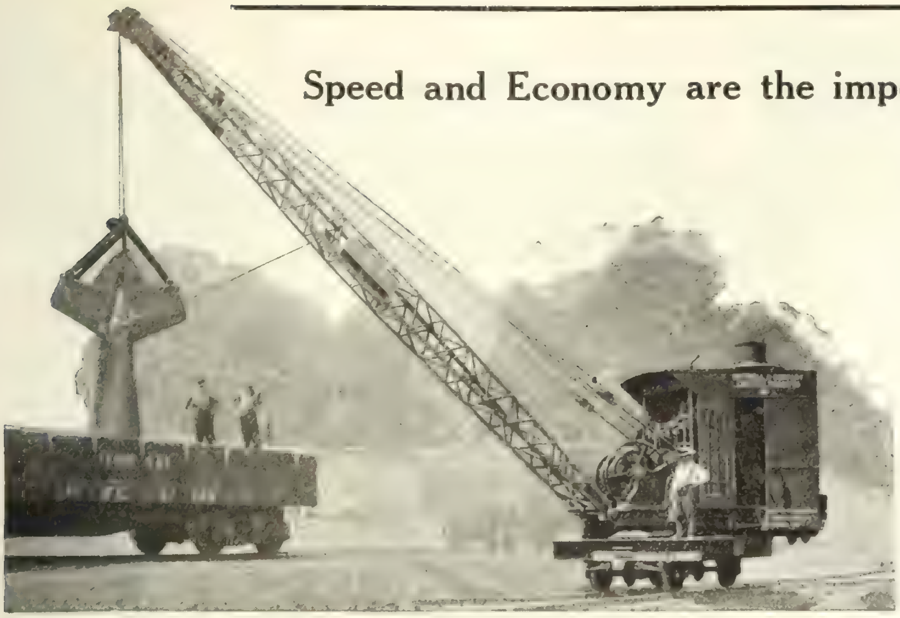

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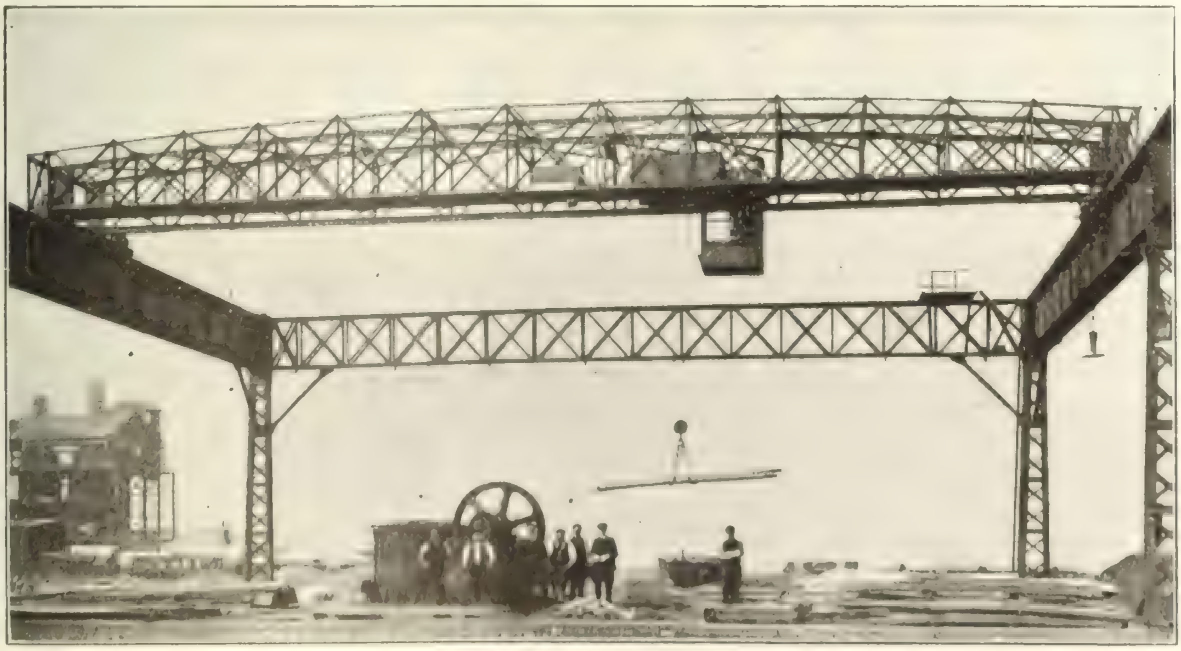

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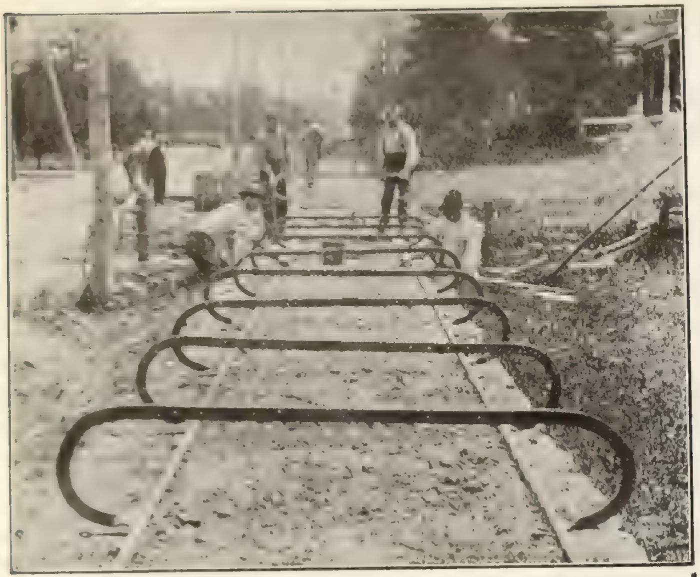

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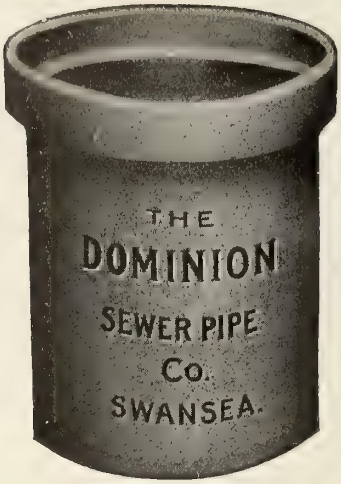

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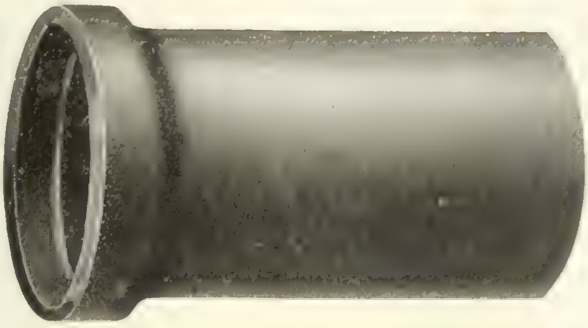

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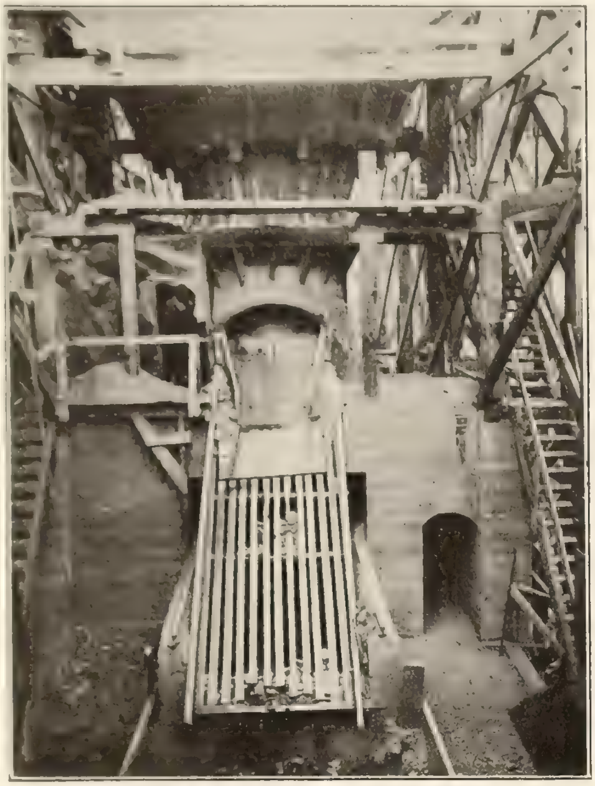

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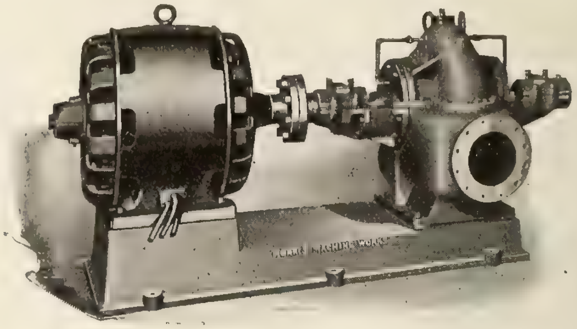

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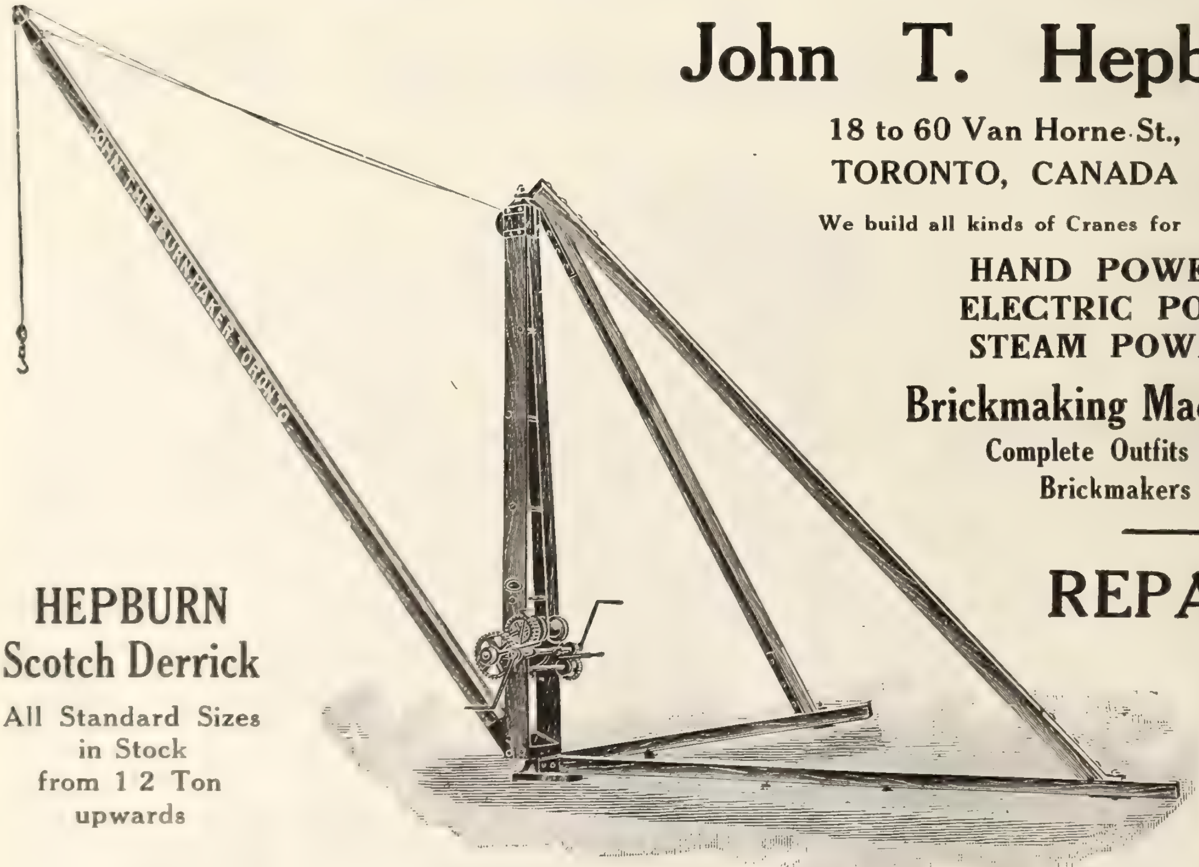
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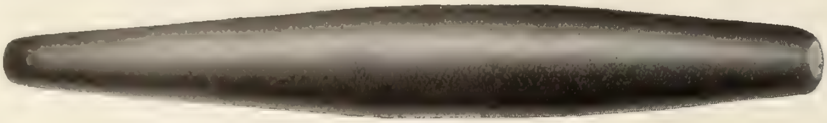

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The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.

Ornamental Lighting Poles

During the past few months we have supplied ornamental lighting standards for the following places:—

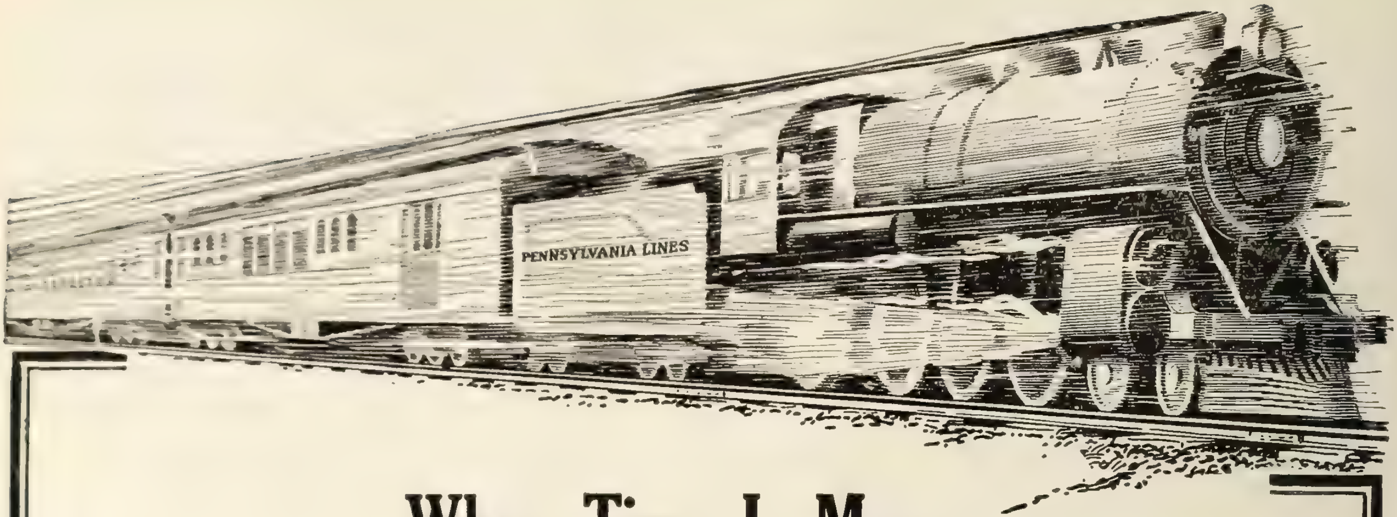
Brantford, Ontario
Edmonton, Alberta
Windsor, Ontario
Outremont, Quebec
London. Ontario
Orillia, Ontario
Listowel, Ontario
Peterborough, Ontario
Belleville, Ontario

Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company
Peterborough, Ontario

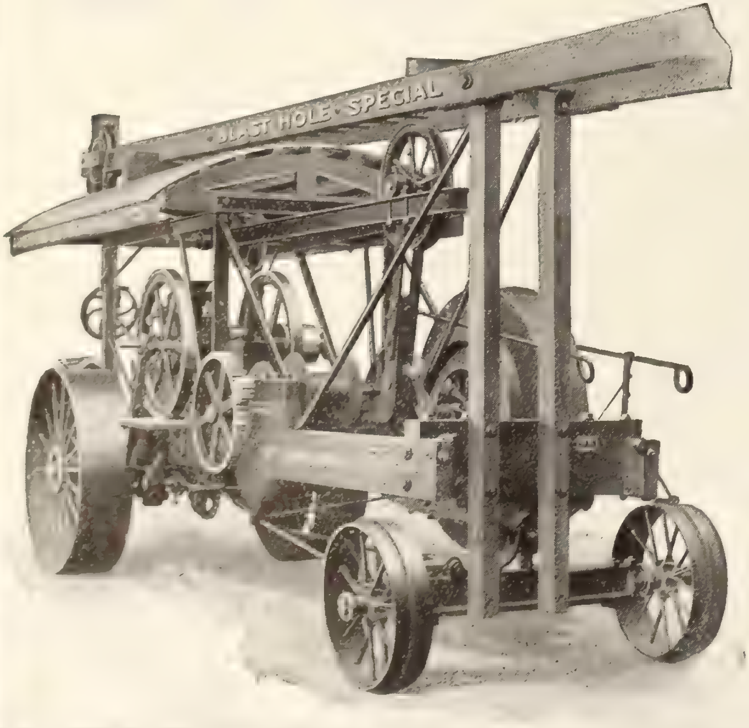


When Time Is Money You Take the Limited—Not the Local

Buy an Armstrong Special Blast Hole Drill. It works faster, makes fewer stops, and saves *your* time. Time means *money to you.* Saves time because it drills more hole in a given time than any other cable drill—this is due to a special spudding beam and motion which allows both for longer strokes and a greater number. Each stroke is unhampered, due to the free fall which the Armstrong Special allows the string of tools. There are fewer stops because the Armstrong Special is designed for rock drilling alone and repairs and breakage are practically eliminated. The maintenance cost is lowered because the whipping of the cable is eliminated.

Armstrong machines are equipped with our powerful gasoline engines, made in our own factory, which are especially designed for this machine to give continuous and rapid operation. They are built with the idea that the operator is there to watch the drilling and not the engine.

We could not afford to give you our guarantee nor put our name on the machine if the Armstrong Special would not deliver all that we claim and more.



Guarantee

We guarantee the Armstrong Special Blast Hole Drill to drill more hole in a given time than any other cable drill on the market, and we will write this in every sale contract we make.

Write for Bulletin S.

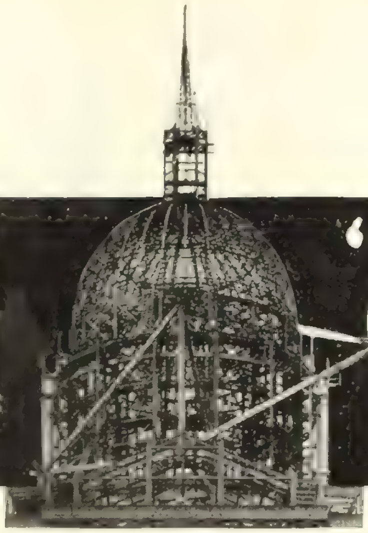
Armstrong
MFG. CO. WATERLOO, IOWA. U.S.A.
BUILT FOR SERVICE
SINCE 1867

Eastern and Export Office:
17 Battery Place
New York City

Western Branch:
3rd and San Pedro Sts.
Los Angeles, Cal.

Canadian Branch:
Drinkle Block No. 2, Saskatoon, Sask.

Right "On the Job"



Hose that Gets the Work Done

For out of the way places where power is to be delivered full force—none lost on the way—Goodyear hose is fast winning first place.

Exclusive Goodyear Hose features mean super-service and utmost economy.

Every Goodyear product is designed to set a new specific standard. The element of mere "price" is never a determining factor.

Buying Hose this way insures day in and day out serviceability. No break-downs or "lay-offs" due to inferior equipment.

Goodyear Steam Hose

This has an inner tube that resists the action of steam and oil. Under a 1446 hour test at 100 pounds steam pressure, with oil injected, this Hose showed no deterioration.

Because of the high quality of its inner tube, Goodyear Steam Hose does not rapidly harden and disintegrate like inferior hose made to meet a price.

Comes both Marline covered and wire wound. The latter insures protection under rough usage. Adds to the life of the Hose.

GOOD YEAR
MADE IN CANADA

Goodyear Pneumatic Tool Hose

This also has a special oil resisting lining. Comes wire wound if desired to protect it against rough handling in building operations. A fine hose for the contractor and builder. Its serviceability can be depended upon at all times.

Black Diamond Hose

For moderate steam pressures, yet of a quality that makes it superior to some others designed for high pressures. Comes with a Marline woven jacket that allows for even expansion and also makes handling easy.

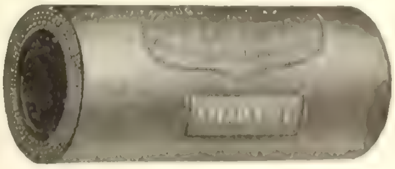
Ask Goodyear

Tell Goodyear experts your Hose problems. They will gladly help you solve them. Also, ask about Goodyear Belting, Packing and Valves for every service. All made at the Goodyear factory at Bowmanville, Ontario—under the same quality standards that have won Goodyear leadership in automobile tires.

The Goodyear Tire and Rubber Co. of Canada, Limited

Head Office TORONTO, ONT. **Factory** BOWMANVILLE, ONT.

Branches at Vancouver, Edmonton, Calgary, Regina, Winnipeg, Hamilton, Toronto, Ottawa, Montreal, St. John, N.B.



What's the Time?

There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., LTD.

Leicester, England

Standard Compression Hydrant

6" Hubbed

KERR

Hydrants and Gate Valves

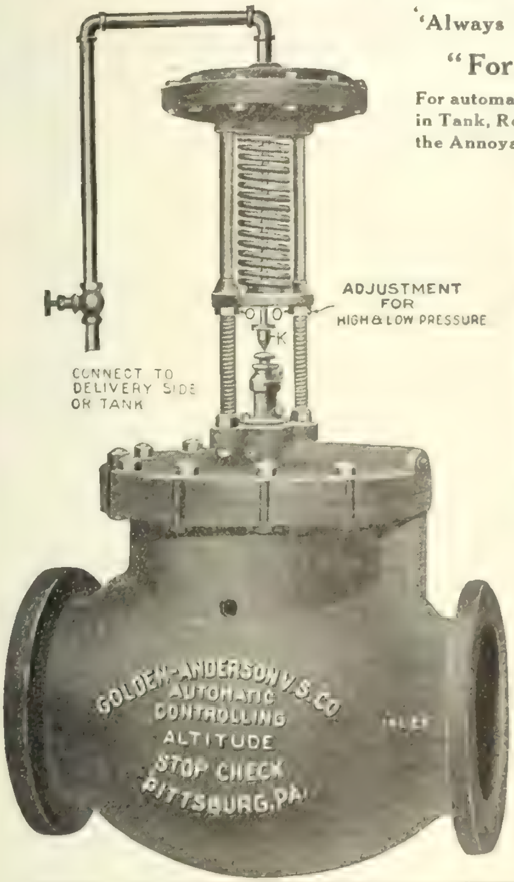
are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

Send us your Specifications and Enquiries.

Prompt attention given.

THE **KERR ENGINE CO.**
LIMITED
WALKERVILLE, ONT.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

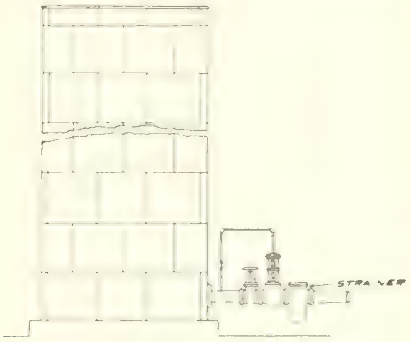


"Always Cushioned in Opening and Closing"

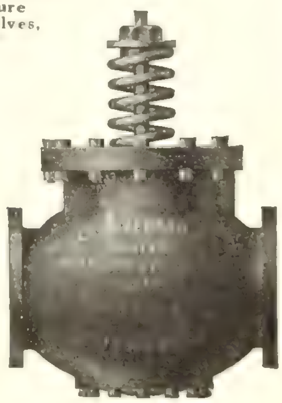
"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

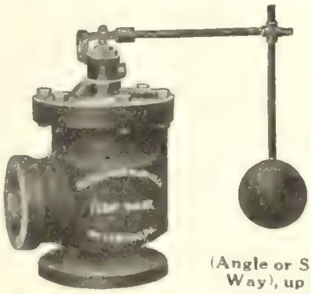
Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24

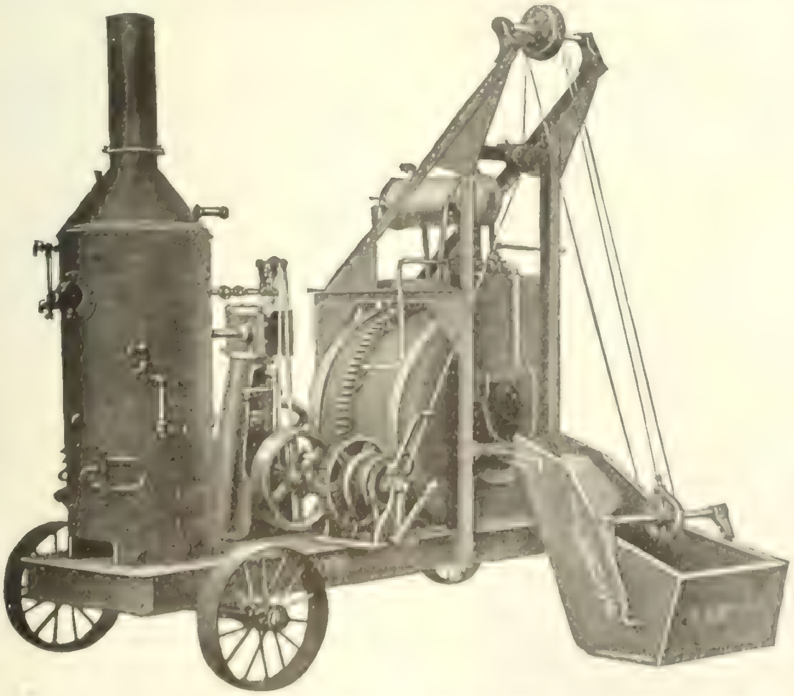


Golden-Anderson Float Valves



(Angle or Straight Way), up to 24″

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg.
Pittsburgh, Pa.



The London Concrete Mixer

A TRIUMPH OF SCIENTIFIC PRINCIPLES.

Once a Specialty—now a question of our output capacity.

Our factory is working full time and we intend to work full time, no matter how long the war lasts. Contractors throughout Canada have learned that it is not necessary to go to foreign countries for their concrete machinery and London mixers are second to no other machines in the world. Our prices are less than those asked by smaller concerns, thanks to the contractors who are patronizing home industries in this time when foreign countries are mobilizing their forces with the intent to invade our markets.

We are the Largest Manufacturers of Concrete Machinery in Canada.

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory: Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES
WINNIPEG, 90 Portage Ave., [illegible] Manager
CALGARY, 622 9th Ave. West, [illegible] Manager
HALIFAX, 68 Upper Water Street, [illegible] Manager

AGENCIES
Vancouver, B.C. Equipment Co.
Montreal, P.Q., [illegible] Hill Machinery Co.
Port Arthur and Fort William, Ont., Northern Agency & Equipment Co.
Quebec, Que., Mussens Limited
Ottawa, The General Supply Co. of Canada.

Electric Steel Castings

Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars

The Electric Steel & Metals Co., Ltd.

Welland, Ontario

Results of 3,000 Tests

on Rail-Steel Reinforcing Bars

The American Society for Testing Materials appointed a Committee to investigate the merits of rail steel reinforcing bars.

Under the direction of Professor W. K. Hatt, of Purdue University, 2,036 samples were collected between September, 1912, and February, 1913.

Upon these samples 2,983 tests were made. The samples were gathered unexpectedly from six mills and represented true working conditions.

In Professor Hatt's report to the Society the following oustanding features are commended upon:—

1. The rail steel **showed an excess ductility** for its strength above the usual grades of steel.

2. 97 per cent. of the plain and deformed bars under ¾-inch bent cold to 180 degrees, and 97.6 per cent. of the bars ¾-inch and over bent cold to 90 degrees.

3. **The material showed remarkable uniformity,** as 80 per cent. of the bars did not vary more than 12 per cent. from the mean tensile strength. (Professor Hatt says that the variability of high carbon billet steel used for reinforcing bars should be known for comparison, but unfortunately no such data was available). The veriability of 12 per cent. in the mean corresponds favorably with the specification limits of from 55,000 to 70,000 pounds per square inch set for the tensile strength of structural steel reinforcing.

4. Professor Hatt says that it was apparent that the process of manufacture had **raised the mechanical quality of the material.** In this connection, it must be remembered that the material to begin with was of the best, as rails, of course, are always made of the highest grade steel.

We would be pleased to submit a complete copy of Professor Hatt's report and to go into the whole subject in great detail with any engineer, architect or contractor who may desire further information.

Burlington Steel Co., Limited, Hamilton

Manufacturers of Rounds, Squares, Flats, Twisted Squares, Angles, Channels T-Bars, Ovals, Half Ovals, Half Rounds, Bands and Special Sections

Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

Structural and Steel Plate Work

is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. **Holyoke, Mass.**

RUST-RESISTING SHEETS

BLACK and GALVANIZED

Actual service tests prove that the so-called "pure irons" do **not** give additional service on account of their alleged purity. The most durable rust-resisting sheets produced to-day are made from

Keystone Copper Bearing Steel

Absolute service tests—not theories—have proved this to be a fact. Send for pamphlet with illustrations and convincing proofs—also ask for prices and full details.

B. & S. H. THOMPSON & CO. LIMITED

Transportation Building
MONTREAL

Traders Bank Building
TORONTO

SELLING AGENTS FOR EASTERN CANADA FOR

UNITED STATES STEEL PRODUCTS COMPANY

NEW YORK, U.S.A.

Branch Offices, WINNIPEG AND VANCOUVER

CIRCUMSTANCES

"Circumstances!" exclaimed Napoleon: "I make circumstances!" And so he did.

In business, as in war, the ability to take advantage of conditions that help and to overcome conditions that hinder, spells "success."

Business men are considering their circumstances now as at no other time. We should like to show anyone so engaged what MacLean Reports have done and are doing with circumstances—how we are assisting scores of firms to secure more business in less time and at a lower cost.

May we tell you about it? No obligation.

MacLean Daily Reports, Limited
25 Charlotte Street, Toronto

The

Manitoba Bridge & Iron Works

Limited

—MANUFACTURERS—

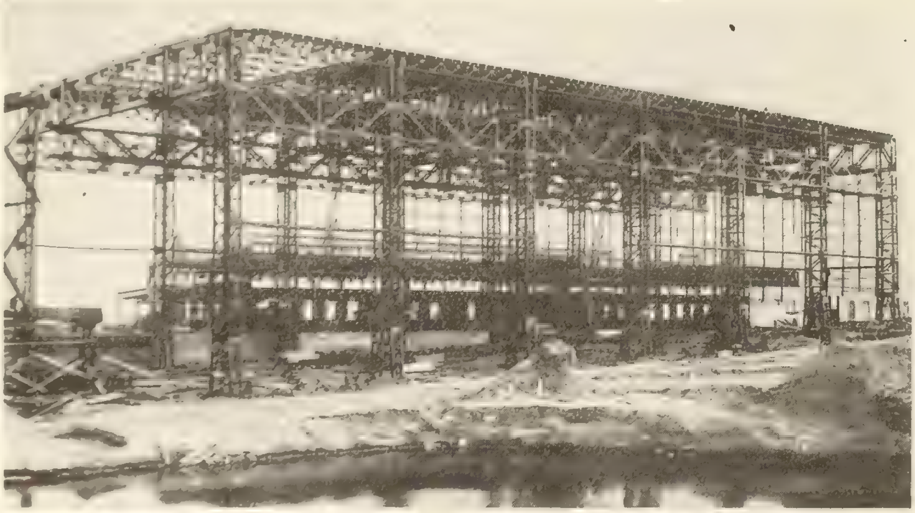
Roofs, Steel Buildings and Structural Iron Work
of all descriptions

Railway and Highway Bridges

6,000 tons of Beams, Channels, Angles, Plates, Flats and Bars always in stock at our works for QUICK DELIVERY, plain or fabricated.
Designs and estimates promptly furnished.

We also operate a Large Grey Iron Foundry, Annual Capacity 5,000 tons
Tank, Forge and Machine Shops.

Office and Works - - WINNIPEG, MAN.



Shipbuilding Berth—Can. Vickers Limited, Montreal
19 days after commencement of erection.

Head Office and Plant:

MONTREAL

Branch Plants:

TORONTO

OTTAWA

WINNIPEG

Dominion Bridge Co., Limited

CAPACITY 100,000 TONS

Large Stock of Structural Material carried at all plants.
Estimates furnished promptly for all classes of Steel Work.

ESTABLISHED 1886

Contract Record and Engineering Review

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The Survival of the Fittest

OUR London correspondent's observations upon a certain class of trade and technical journals (in his letter published in this issue) are rather astonishing coming from England, for we had looked to the Old Country for a literary standard approaching infallibility. It is strange indeed to hear a complaint as to the "horde" which follows in the wake of the representative technical journals of Great Britain.

Undoubtedly this is the time for testing the real worth of the trade and technical press and ascertaining just which papers have the solid foundation to which so many lay claim. Without concentrating our energies upon the misfortunes of the weak we can emphasize the fact that in every field there are publications whose existence is always justified. Come peace or war, come prosperity or adversity, those journals whose pages are edited honestly and whose advertising is sold honestly emerge from a crisis like the present one stronger than when they entered, because ultimately they have the two-fold confidence of their former supporters and the added allegiance of others who have come to appreciate their solid worth. It takes a great shock or a sudden jar to bring some people to their senses, and it may take a war of the present magnitude to impress upon us the meaning of true economy in the field of the trade journal. In some respects war would appear to be not altogether an unmixed evil. The chastening influence must remain. The principle of the survival of the fittest applies to business and intellect, and to the products of business and intellect.

An improved standard may be expected for the reason that during the period of conflict the way of the trade paper will lie along a more rugged road than is travelled in times of prosperity, and that both editorial and advertising standards will be maintained with more difficulty. The standard of the journals which survive this strain must become higher. Their editorial observations will be stronger—presented always in clean-cut, concise English—and the marshalled facts, technical and otherwise, arrayed in the reading pages will be found to better advantage.

The present may be termed a time of compensation. Viewed in some ways depression is a misnomer. Aside from the war, we have to find our own level after a spell of prosperity which led to over-speculation and over-expenditure. In this compensating process the technical journal has a well-defined part and the fittest will survive for greater achievement. The fittest, be it said, are only those which have striven to represent the last word of advancement in the field they serve; whose articles, editorially and technically, have been uninfluenced by special interests, and whose advertising pages have been conditioned by [illegible] favoritism.

* * *

"What is Truth?"

WE read in a well-known Chicago journal the comments of a writer stating that he remembers well the outbreak of the Crimean war and the "blue ruin" that was prevalent for all industries and trades. He tells us that the recovery happened and that with the exception of the time of the trouble in the south there were never better times in the country before or since. He tells us that for a time money flowed like water, that the build ing trades boomed, that employment was plentiful, that hundreds of men—mechanics and others identified with constructional activity—returned to England to take part in the war, that many of these never came back, and that consequently times were good and many obtained an unexpected start in life—in short, that the nation profited immensely. These sentiments are expressed editorially in the October, 1914, issue of the National Builder.

It is our policy to place a broad construction upon optimism that is slightly overdone, excusing the fault on behalf of the spirit in which it was committed: we need optimism and we must not cavil over trifles. But can one accept such absurd statements as those of our contemporary's writer, whose memory in regard to the effect of the Crimean war upon American trade serves him so well? Many of the greatest industries in the United States have been built up of English capital, and England has never and can never pass through such an ordeal as a European war without depression ensuing on the American continent. Hark back another half century and witness the universal depression attendant upon the Napoleonic wars.

Prosperity and depression, and all the intermediate conditions, travel in cycles, and it is a long road in the cyclical movement that will take us to the time when money flows like water. The writer in the National Builder tells us that so long as the combatants confine themselves to cutting each other's throats the United States will go on prospering "with the same even tenor as during the past few years." In such prosperity, of course, Canada would share very largely.

Such optimism is of the variety known as optimism gone mad. The only optimism which can possibly appeal to intelligent men is the optimism which arises out of marshalled facts. Optimism is justified in view of the signal successes of the allies in the two months of the war's duration. Optimism may be found in establishing our manufacturers in colonial and neutral markets in certain lines of trade in which hitherto our enemies have transacted much business. There is optimism in the reflection that home manufactures will have to take the place of imported products. Optimism of this kind will result in a conservative, confident policy which must result in the maintenance of average business conditions and lead us back ultimately to prosperity.

For the month of August which was the first month of the European war, the total Canadian trade reached an aggregate of $100,374,000 compared with $97,832,000 for the corresponding month of 1913, according to a statement issued by Hon. J. D. Reid, Minister of Customs.

The Pennsylvania Railway is trying a rail weighing 120 lbs. per yard, so going one better than the 110 lb. rail used on the Lehigh Valley for heavy gradients and sharp curves. With these two exceptions the heaviest rail in the United States is one of 100 lbs. In the Pennsylvania new rail the head is 41 per cent., the web 22 per cent., and the base 37 per cent. The sides of the head have been given the steep slope of 8 deg., and the top has the short radius of 10 ins., the corner radii being 7-16-in. The fishing angle under the head is one of 18 deg., and above the base one of 13 deg. The height is 6¼ ins.

Imports of Constructional Materials

TALKING about optimism in its relation to marshalled facts, statistics are not lacking to prove that Canada now has an unparalleled opportunity to pave the way for greatly increased trade. Herewith we present a table of imports covering the leading lines of the constructional interests, showing Canada's purchases from Germany, Austria and other countries. They will repay the careful study of Canadian manufacturers seeking to divert trade to Canadian and British channels.

	Germany	Austria	other Countries
Asphaltum or asphalt	$ 9,259	......	$ 857,720
Baths, bath-tubs, basins, closets, lavatories, urinals, sinks and laundry tubs of any material	......	......	452,748
Bricks, tiles, clays	4,217	......	3,263,930
Cement	885	......	351,249
Cordage, rope and twine	1,108	2,417	3,788,936
Earthenware and chinaware	300,595	74,834	2,755,876
Electric Apparatus	204,388	21,767	8,698,159
Glass and Manufacturers of:			
Common and colorless window glass	2,708	......	1,494,714
Plate glass, not bevelled, in sheets or panes	7,081	......	912,842
Silvered glass, bevelled or not, framed or not framed	30,577	603	139,507
Other Glass	385,843	52,283	2,284,004
Glue, glue stock and mucilage	38,380	10,667	357,242
Gunpowder, explosives, etc.	61,844	......	1,221,573
Gutta - percha, India - rubber, and mnfrs. of:—			
Rubber and gutta-percha, crude caoutchouc or India-rubber unmanufactured	50,558	......	3,199,531
Lime	......	......	243,700
Marble and mnfrs. of:—	......	......	531,329
Metals and Minerals and mnfrs. of:—			
Bars, bands, hoops, rods, sheets and plates	55,137	......	28,468,573
Billets of iron and steel and ingots	68,728	......	4,280,423
Machinery	248,976	16,869	28,372,733
Nails and spikes	......	......	270,634
Pumps	21,279	......	....
Steel rails	2,289	......	4,920,506
Structural steel of every type	85,138	......	9,755,290
Tires, metal	348,059	......	204,680
Tools and implements	66,724	......	1,218,497
Tubing, brass, copper, iron and steel	539,130	......	3,711,725
Wire	140,523	......	4,226,713
Wire rods	51,574	......	1,638,615
Metals and Minerals and mnfrs. of, not included above:—			
Agricultural implements	......	......	3,274,693
Castings, iron or steel, N.O.P.	......	......	1,401,766
Cast iron pipe of every description	......	......	806,832
Cast scrap iron	......	......	491,377
Chains	......	......	611,545
Engines, locomotives for railways, gasoline, etc., including boilers	......	......	4,709,127
Fittings, iron or steel, for iron and steel pipes	......	......	1,019,805
Hardware, viz., builders' cabinet makers, etc.	......	......	843,486
Iron or steel nuts, rivets and bolts, with or without threads, nut, bolt and hinge blanks, T and strap hinges of all kinds, N.O.P.	......	......	285,606

Iron or steel scrap	......	.	611,546
Mould boards or shares or plough plates, land sides and other plates for agricultural implements, cut to shape from rolled plates of steel but not moulded, punched, polished or otherwise manufactured	. .		227,518
Ore of iron			1,027,460
Switches, frogs, crossings and inter-sections for railways	.	. . .	282,724
Ferro-silicon, spiegeleisen and ferro-manganese	194,999	......	670,222
Locks of all kinds	[illegible]	. .	456,239
Stoves of all kinds	9,408	......	826,570
Other iron and steel	392,153	12,066	13,085,095
Lead and Mnfrs. of—			
Old scrap pig and blocks.	......	......	464,842
Other lead and mnfrs. of.	10,441	1,547	466,506
Tin and mnfrs. of:			
Blocks, pigs or bars	......	......	1,959,940
Other tin and mnfrs. of ..	[illegible]	563	[illegible]
Zinc and mnfrs. of	108,736	81	761,146
Miscellaneous metals and minerals and mnfrs. of:			
Alumina	......	......	600,454
Aluminium in ingots, blocks, bars, rods, strips, sheets, or plates .	37,497	......	684,355
Aluminium, mnfrs. of N.O.P.	[illegible]		. .
Gas, coal oil or other lighting fixtures, including electric light fixtures or parts thereof, metal, lava or other tips, burners, collars, galleries, shades, shade-holders	17,735	......	687,216
Ingot moulds, glass moulds of metal			254,282
Lamps, side-lights and head lights, lanterns, chandeliers	137,710	177,078	1,196,499
Nickel, nickel silver and German silver, in bars and rods, in ingots or blocks, and also in strips, sheets, or plates .			144,343
Ores of metals			983,420
Platinum wire and platinum, in bars, strips, sheets or plates	......	......	116,698
Paints and colors	[illegible]	[illegible]	[illegible]
Hangings of wall paper including borders	17,595	......	418,649
Tarred paper and other building paper, N.O.P.			[illegible]
Slate and mnfrs. of:—	6,077	......	229,961
Stone and mnfrs of:—	......	......	2,076,127
Tar and pitch	......	......	200,458
Varnish, lacquers, japans, japan dryers and oil finish, N.O.P.			[illegible]
Wood and mnfrs. of:—			
Furniture	[illegible]	[illegible]	[illegible]
Other wood and mnfrs. of	[illegible]	[illegible]	[illegible]

TORONTO leads in municipal work with operations involving an expenditure of nearly $3,000,000 under way or projected. Of this amount $1,[illegible] is being spent on sewers and the balance on miscellaneous improvements, such as roadways, sidewalks and gradings. Apart from this work the city is building a new filtration plant at a cost of over $1,000,000. Good progress is also being made on the 84-in. steel pipe line across Toronto Island, the cost of which is estimated at $540,000. Additions to the pumping and distributing system will cost upwards of $50,000. The Works Commissioner, Mr. R. C. Harris, informs the Contract Record that the city will be able to complete without any difficulty the programme of work outlined for the season.

The Middle Course

THE Minister of Finance, Hon. W. T. White, in his recent public utterances, voices the exact sentiments of the more thoughtful of the Canadian people, when he counsels municipalities, railways and large industrial concerns to steer a middle course in carrying out their programmes of expenditure. Mr. White evidently has no sympathy with those manufacturers and others who, at the first sign of trouble, summarily dismiss their employees, and close and bar their doors, thus accentuating the difficulties which others, more loyal and sane, are endeavoring to forestall.

The middle course has already proved an eminently satisfactory one for business men throughout the Dominion. A readjustment is evidently taking place. As Mr. White says, the worst effects are gradually wearing away. Many of our industries have suffered, but on the other hand, many have been greatly stimulated. The higher prices for grain and other agricultural products will more than neutralize the shortage in amount. Increased agricultural production will be inevitable. This has been the great need in Canada for many years and will help to solve the problem of the high cost of living, with its attendant evils—the overcrowding of cities and consequent unemployment. As a result of the scarcity of certain raw materials, new industries will spring up, and with the increased demand for manufactured products, Canada has unexpectedly opened to her the means of becoming recognized as a manufacturing centre. The first duty of every Canadian is to put forth his utmost effort to increase production and add to the national wealth, not only that the wastage of war may be repaired, but also that the opportunities offered by the conditions which the war produces may be taken advantage of to their fullest extent.

Does the Publication of Costs Endanger the Contractor?

A SUCCESSFUL contractor whose practice it was to keep very careful costs of his construction operations once refused permission to publish some of these costs because they constituted his only stock in trade. This contractor was unusually expert in organizing construction forces, in selecting and handling men, in planning construction plants, in purchasing supplies and materials and he had a reputation for honesty and general reliability. His unit costs were less than those of his competitors; in general he bid more closely than did his competitors, and his profits were more certain and frequently larger than were theirs.

This example is not stated because it is exceptional. Many contractors refuse to permit publication of their costs. It is of course their privilege. To refuse publication on the plea that their "stock in trade" is thus made free to their competitors is, however, not logical reasoning. Considering the example cited, it is evident that these construction costs were not his "stock in trade," but were merely the results of his managerial ability and his business integrity which were his real "stock in trade." As we see it, this contractor and [illegible] contractors who conceal their costs fear two possible dangers from publication: First they fear that competitors will imitate their methods and be thus enabled more frequently to underbid them. Second, they fear that engineers knowing the actual costs may lower their estimates and force the contractor to take work at lower prices. Let us consider the force of these suppositions.

Personal knowledge of the operations of several competing groups of contractors in widely separated parts of the country is had by the editor. As a rule the contractors in each group operate in a limited area and bid against each other on nearly every job coming up during the course of the year. Although competitors, these men are usually friendly, clannish and even "chummy." They know each other and each other's methods thoroughly. Each man frequently visits the work the others are carrying on, often travelling considerable distances to do so. It is not necessary for one of these men to read about his competitor's methods since he is familiar with them as a result of direct observation. The experienced contractor knows a good method when he sees it and is quick to adopt it without any published prompting. He can tell at a glance if a job is being handled well and economically. As a result of this practice of inspection the alert contractors in any group employ substantially the same methods. Therefore the only ones who conceivably might profit from the description of a construction method to the disadvantage of the one giving out the description are familiar with the method before it is described. The reason for describing it is to help men in other localities whose operations, as a rule, do not interfere with those in the locality in which the method originated. Since costs are a direct result of conditions and methods there can be no more objection to their publication than to the publication of descriptions of methods. In either case objection to publicity is illogical since, as we have pointed out, methods and costs in any locality are continually undergoing a process of adjustment which trends toward a common level.

Nowadays nearly all engineers keep cost data with reference to the contracts under their charge. These data are kept with sufficient accuracy to serve the engineer's purpose in making estimates. While it is not the engineer's purpose to spy upon the contractor such cost data as he compiles are entirely adequate to show whether the contractor is making an exorbitant profit or not. Further than this, the engineer's interest in this connection does not extend. He expects the contractor to make a fair profit and is much distressed if the contractor is losing money. This is well shown by the fact that engineers usually make all the concessions possible when contractors are working at a loss. Therefore, since engineers keep cost data sufficient to their requirements, the contractor should not withhold the publication of such data in the belief that they will be turned to his disadvantage by engineers.

It should be borne in mind that there are other forms of valuable output data which can be published without throwing any light upon the contractor's profits whatsoever. Only cost data of the dollar and cent variety, covering the entire job, taken into account with the contract price, serve to indicate the contractor's profit or loss. If the contractor appreciates the value of giving publicity to his work and wants to help others without giving an insight to his profits he can readily do so.

It is seldom necessary, in fact it is sometimes altogether undesirable, to give unit costs for every item on a large construction job. Thus where a large part of a job consists of trenching and pipe laying, for example, and other less common features are included in the same contract, preference may well be given to the latter in giving out cost data. Thus the contractor may often give out highly interesting, valuable and complete cost data on a part of his job without furnishing any idea to the outsider of the amount of his profit or loss on his entire contract.

Again, where there is a large amount of trenching and pipe laying, as in the above illustration, typical sections 1,000 ft. or more in length may be selected for observation and subsequent publicity purposes, even if costs are not kept on the entire job, or if it is considered undesirable for any cause to give out costs relating to the entire job.

Finally, it should be borne in mind that one can entirely avoid the dollar and cent form of presentation and still give publicity to valuable data in a very convenient form. To the editor's mind one of the most valuable articles, giving output data, ever published in this journal occupied less than a column of space and didn't have a dollar sign in it. The article related to the laying of pipe sewers in a Wisconsin city. All the soil and other conditions were briefly but adequately described, as were the construction plant and methods employed. An intensive time study was made per 1,000 ft. of pipe line completed. The data obtained were recorded as so many days and fractions of days required by each class of labor employed in laying 1,000 ft. of sewer complete. This included supervision by foreman, the contractor's personal time spent on the work, etc. We commend this form of presentation to the contractor who has an ill-defined dread of seeing the dollar mark too prominently displayed in published accounts of his work.

Alert contractors are coming to appreciate the value of publicity. The benefits of publicity can be obtained as here suggested without revealing profits and without greatly reducing the serviceableness of the data made public. Moreover, as shown herein, the dangers arising from the publishing of even very full and complete data of the dollar and cent variety are largely but figments of the imagination.—Engineering and Contracting.

Trade and Market Conditions at Winnipeg

TRADE conditions in Winnipeg are not nearly as bad as many people believe. There are good sales in many lines, while others show signs of rapid improvement. There are a number of building blocks under construction, while the Government are expending a further $2,000,000 on new buildings. Civic improvement in the laying of sewers, etc., continues quiet.

The various firms interviewed are of the unanimous opinion that if the banks and loan companies would advance loans promised, trade would soon start up again. Many of the contractors are unable to finance work owing to trouble in this direction. Were the banks and loan companies less stringent, many contracts which are now closed down would be proceeded with, and market conditions would benefit materially.

There is a fair demand for the materials of construction. A slightly freer movement is reported in lumber, although conditions in the lumber industry leave a good deal to be desired. Market prices are still as quoted previously in our price list.

Firms handling cement report a good call for this product, as do manufacturers of steel and iron. Prices remain unchanged.

Business in the paint and oil line is very brisk—in fact one large firm reported that sales in this line fall short of those of last year only by a few hundred dollars. There is every likelihood of a good trade being quoted.

Sales are very quiet in the plaster of Paris, wall plaster, and sewer pipe lines, although there are signs of improvement. Prices are unchanged.

The demand for cast iron pipe continues to be fair. The price per carload lot, f.o.b. Winnipeg, is quoted at $38.

Engineering Topics In The Old Land

An Outcome of the War—The Situation and Outlook in the Timber Trade—Engineering and Sex—Licenses at Calgary

Special London, Eng., Correspondence to the Contract Record and Engineering Review

London, Oct. 13, 1914

THAT the technical press has been very hard hit by the war is not a matter of surprise, but it is really astonishing how many small papers have succumbed under the first undue strain placed upon them. The reason is not perhaps after all far to seek. Attached to the few standard papers, which are passably if not brilliantly edited, is a horde of papers of the limpet type, which batten upon the advertiser and suck him with leech-like assiduity. Their literary pages are a farce, consisting entirely of clippings, and even their editorials contain merely four or five lifted paragraphs tagged together by an ungrammatical and non-committal commentary. Contributed articles are the dodos of their pages. Their circulation—at least their bona fide circulation—is nil, and a quire of sales would lift their editor-proprietor-managers to the seventh heaven. Gratuitous circulation is what they depend upon, and they are not above making a boast of the important officials "who take it." Could the waste-paper baskets of these officials be inspected it would be found that not one in ten of the papers which arrive by post is ever stripped of its wrapper. There is a paper now which has, to the writer's knowledge, been running for over twenty years, and if its circulation has ever reached ten per issue the writer is open to weigh out a proportionate number of dollars for any home that may be running for the reception of decayed editors. Advertisements are obtained on the principle of "get what you can." If three pounds per page is too much, then take two, or one; and close the deal even at ten shillings. At every hazard the advertising sheets must be filled, and one good firm (even at ten shillings) spells many smaller firms at possibly paying rates. It is small wonder that with the temporary withdrawal of the advertiser such papers cease publication.

Timber Shortage

A shortage of the cheaper kinds of timber would have been a serious matter in this country, in view of the large quantities that are in requisition for the erection of temporary buildings and the carrying out of temporary works. [illegible] Germany has declared Swedish deals, battens, boards, staves, and packing-case boards to be non contraband of war, provided that they are carried in neutral bottoms. Finland, which exports a vast amount of timber to England, is of course Russian, and although Russia quickly removed her prohibition against the exportation of timber, sufficient awkward facts remain to reduce the customary [illegible]. A great quantity of timber of the cheaper kinds comes also from Archangel and other White Sea ports, and the trouble there now (according to one who is an authority on the matter) is the difficulty of loading, on account of the shortage of labour arising from the calling up of conscripts. "A friend of mine," (he writes) "sent a boat out at the commencement of the war, but it was returned empty because of the prohibition. He had £12,000 worth of Archangel deals and boards on order, which would have been very profitable to him during the coming winter, but he told me that he had since cancelled the order because of the difficulties of loading. If it could not be loaded before the White Sea had frozen (and the White Sea ports close earlier than any other timber exporting ports) he was afraid they might take fire before they could be loaded per 'first open water' in the spring. They have very frequent fires in Archangel on account of the tremendous quantities of timber stocked there, and the difficulty would be for him to prove that it was not his timber that got on fire. It is a very difficult thing to prove after a fire that it is or is not your timber that has been burnt, because there are thousands of other stocks of exactly the same size all piled together." The same authority is of the opinion that if the price of Baltic and Archangel timber goes much higher during the war, American spruce and cheap pitch pine will have to take the place of deal.

Engineering and Sex

At the beginning of the year 1910, the engineering world—or at least that section of it to which coal-gas manufacture and distribution specially appeal was startled by the announcement that a lady had been appointed manager of the gas works at Magherafelt, County Londonderry, Ireland. [illegible] to her qualifications for the post. She had worked for thirteen years side by side with her brother, a gas-works manager in Kilkenny, and she was said to know almost as much about the work as he did. Some time previously a lady had been appointed surveyor to an Irish county or borough council (it is unimportant which) but the appointment was not finally ratified. [illegible] and now one hears that the New Zealand Institute of Architects have admitted a lady to associate membership of their society. The time must necessarily come when women will have equal opportunities with men in all walks of life and when physical and mental attributes alone (especially the former) will decide the battle. The Royal Sanitary Institute admits ladies, but of course that is not a professional body, its certificate being regarded as of little value except as a qualification (among others) for sanitary inspectorships. Many professional men use its agnomen, but only when they can place other, and higher, agnomina before it. The admission of both sexes has certainly cheapened the Institute "diploma," and it is to be hoped that the same misfortune will not visit the New Zealand Institute of Architects.

The Calgary Municipality

The "Municipal Manual: City of Calgary, 1914" is a compact little volume of nearly 300 pages, and reflects high credit upon its compilers. It gives English readers much food for thought, and should especially interest home engineers who contemplate seeking their fortune across the pond. Popular representation such as obtains here in the case of at least district councils has no place in Calgary, owing to the introduction of a property qualification. In England anyone, of either sex, may be elected a district councillor, provided that he or she "is a parochial elector of some parish within the district, or has during the whole of the twelve months preceding the election resided in the district." Hence, nearly every council contains its quotum of working men, and the engineer suffers accordingly! A most interesting study for the English reader is the list of licenses. It would seem as though almost everybody is licensed in Calgary, and it approaches the farcical when $5.00 per day has to be paid for "demonstrating self in window." Master and journeymen electricians and plumbers have to take out a license, as does a master gasfitter, but the journeyman gasfitter appears to be exempt. A premium is placed upon cleanliness by the licensing of chimney sweeps, house cleaners (when using machinery), scavengers, and window cleaners, and there really seems no reason (to take one instance) why if a man pays $20.00 a year for permission to clean windows he should not pay a similar amount for permission to clean doors or railings or front steps.

Still, there is wisdom in many of the provisions, and the authorities here might well consider the licensing of plumbers, electricians and gasfitters. The permit system, too, is a good one as applied to these trades, although it does not seem to be in operation in every case even in Calgary. Here, in free England, anyone may plumb, or gas fit, or electricise (to coin a word for the occasion) without let or hindrance, and the result is to be seen in work of the most disgraceful kind. Architects, surveyors and engineers appear to go license-free in Calgary, as they do here, and it is somewhat anomalous that the men who design the systems should not receive equal, if not more stringent, treatment than the men who merely carry them out. By-law 1502, which regulates the use of streets, deserves the final word, owing to its peculiarly contradictory enactments. First: No person riding in or driving any automobile shall go at an immoderate rate of speed in the streets. Second: Within the limits of the city the maximum speed shall be 6 miles an hour except approaching a crossing of intersecting streets, where the maximum speed shall be 5 miles an hour. Third: The limitation of speed to 6 and 5 miles an hour respectively shall not apply to automobiles or other vehicles propelled or drawn otherwise than by horses or other animal power and used solely for the conveyance of persons, for which the maximum speed shall be 10 miles an hour within the limits of the city, except approaching a crossing of intersecting streets, where the maximum speed shall be 5 miles an hour. Supplementary to these is a note to the effect that the Provincial Government's Motor Vehicles Act provides that the speed for machines of this nature shall not exceed 20 miles per hour, and that this Act takes precedence over the by-laws by any municipality in this respect, but does not over ride the provisions of by-law 1502 of the City of Calgary, governing speed which may be attained at street crossings. Calgary motor vehicles may therefore go at 20 miles an hour, a speed as great as that customary in London.

Among the several problems to be met in the recent construction of the concrete reservoirs in San Francisco was that of bonding asphalt to concrete. According to B. N. Abbott, in a letter to the Engineering Record, after making unsuccessful attempts to apply the asphalt direct to the concrete in various ways, the expedient of first painting the surface with coal tar was tried, and it was found that when applied in this way under right conditions the asphalt would adhere so firmly that after it had cooled it could not be broken away without bringing pieces of concrete with it. Mr. Abbott states that in order to secure this result the concrete surface was first scrubbed clean with a bristle brush, and over this a thin coating of hot coal tar was "painted." The coal tar should be heated in small quantities, brought just to the boiling point, and then applied immediately. Heating the coal tar in large quantities, which necessitated some delay before it could all be used, did not give such good results, and the men were therefore not allowed to heat more at a time than they could apply quickly as soon as it began to boil. The asphalt was spread over the tarred surface in the usual manner.

In connection with the construction of the three-mile Mount Royal tunnel of the Canadian Northern Railway at Montreal, six small storage battery locomotives are being used to haul 175 tunnel dirt cars. The storage batteries are carried on trailer cars, there being two batteries for each locomotive. These locomotives were originally operated by petrol engines. It was hoped that the carbon monoxide in the exhaust could be changed to dioxide by passing over lime, but this was only partly successful. The fumes finally became so objectionable that 110-volt electric motors were substituted for the engines, the locomotive gearing being left practically without change and the trailer car with a sixty-cell storage battery being added to each locomotive to supply the current. Recently, since the hauls have become longer and a larger tunnel cross-section has been available so that a trolley wire could be used, these same locomotives have undergone still another change. A trolley pole and another 110-volt motor have been added, the two motors operating in series and being supplied with 220-volt current from the trolley wire.

Pursuant to a request made to the Dominion Government for the granting of some measure of assistance toward the development of iron ore mining in Canada, and in accordance with the statement of the Minister of Finance in his budget speech during the 1913-14 session of Parliament, that the iron mining industry would be investigated, a Committee has been appointed to enquire into the situation and report the facts to the Government. Every owner or operator of an iron ore property in Canada should be interested in facilitating this enquiry and communicate with the Deputy Minister of Mines at Ottawa, or the Secretary of the Committee, who will furnish a schedule of questions covering the information required by the Committee.

The Pacific Coast Highway

In addition to the great Canadian automobile highway now in course of construction from the Atlantic to the Pacific, of which Vancouver is the western terminus, the Pacific-coast highway extending from San Diego to Alaska via Vancouver is being linked up, and by the end of 1915 motorists will be able to make the trip from southern California to British Columbia over a hard-surfaced road. The route will include the principal cities on the coast and will afford one of the most attractive motor trips on the continent.

Approximately $7,000,000 was spent on road building in British Columbia in 1913, and every settled section of the province is being provided with good roads. As practically all the original transportation routes in this district were from east to west, special attention is now being given to the building of north and south lines of both highways and railroads. The purpose is to open up lines of coastwise communication connecting the main arteries of traffic extending from the eastern and central provinces to the Pacific coast. This is especially true of motor roads, and at the present rate of progress in construction British Columbia will soon be provided with highways suitable for motor traffic from the border of the United States to Yukon Territory.

That portion of the British Columbia section of the Pacific highway from Vancouver to Blaine, Wash., was recently definitely marked, and other divisions in the province are being connected. For several years various sections of good motor roads along the coast have been in use, but only within the last few years has there been a concerted effort to connect the completed divisions, making one continuous highway through the Pacific Coast States and British Columbia.

The plan of the Pacific Coast Highway Commission, which initiated and has been the moving factor in the construction of a motor trail along the Pacific coast, is ultimately to include Yukon Territory and Alaska in the route. Great progress has been made this year in road-building in Yukon, among the most important stretches of which is the overland road between Dawson and Whitehorse, on which grades are being reduced, sharp curves eliminated, and fills and surfacing added. One of the most important improvements on the road near Dawson is the straightening of the highway on the east side of the Ogilvie River, where the road was destroyed by dredges last year. The old roadway followed a tortuous course which made travel dangerous, especially automobile traffic, because of the steep grades and curves. The plan of the Yukon Territorial government is to improve the existing highways and construct new roads, establishing a system connecting with routes through British Columbia and the new roads being built in Alaska, extending the automobile route from the semi-tropical regions of the [illegible] to the land of the midnight sun.

The engineers detailed by the Alaskan Road Commission to survey the proposed Government highway from Skagway to the summit of the White Pass have completed the work and are now preparing maps and data for the route. The road is to connect at the international boundary line at the summit of the pass with the Canadian system of roads leading to the Atlin section, and to Yukon as far north as Dawson. The road from Skagway to the summit will have a grade averaging less than five per cent. and at no place will it exceed eight per cent.

According to the new survey the route follows for the greater part of the distance the old '97 trail, leaving out that section of the road leading to Black Lake, but continuing on the west side of the Skagway River to Rocky Point, avoiding the long, steep grade to Black Lake. The route passes through historic Liarsville, a former lively station on the '97 trail, from where it approaches a sheer wall of granite, which will require either trestle work or extensive cribbing for a long distance. At Mile No. 7, of the White Pass & Yukon Railway, the great scenic beauty of the road becomes apparent, and the route continues to increase in attractiveness as it winds up through the rocky canyon of the Skagway to White Pass City, once an animated municipality living on the adventurous gold seekers passing to and from the mining regions farther in the interior, but now reduced to a deserted village consisting of a few uninhabited cabins. The scenic aspect of the road continues to grow in interest until the summit of the pass is reached, and the route, when completed, will present attractions that will make it one of the great popular thoroughfares of the Northwest for summer tourists and motorists.

With the completion of this route, motorists living in any section of the coast country will be able to make the journey from southern California to Alaska, with such side trips as they may desire to include. The popularity of the Pacific-Coast highway is assured, as it passes through a country possessing special scenic attractions, and in which, most of the way, during the greater portion of the year, good weather and favorable conditions are assured.

The great continental and coast highways will make Vancouver the objective point for motorists from the East and South.

A particularly smart piece of work in the way of installing electrical machinery and erecting poles, has just been carried out at Sheds No. 24 and 25 on the Montreal Harbour. The Government decided to fit up these sheds for baling compressed hay for the cavalry which are going to the front, and to obtain the necessary electrical power, a new line had to be constructed and machinery installed. By working day and night the poles were put up, the buildings wired, and the machines installed in a very short time. Sixteen very heavy compressing machines are now in operation. These are electrically driven, the current being supplied by the Montreal Light, Heat and Power Company over a special line. It is transformed from 2200 volts to 550 volts, three 75 kw. transformers being used. The Government purchased four 100 h.p. Canadian General Electric motors, each motor driving four compressing machines. The small sub-station in which the transformers are located was partially built, and the remainder of the work was done under great pressure.

A direct outcome of the war is the opportunity afforded Canada of increasing her sales of iron and steel manufactures, as she is already exporting to the value of ten million dollars annually. Special attention might be given to nails, hitherto purchased in large quantities from Germany.

Economics of Water-Waste in Cities

The Increased Cost of Constructing and Operating Water and Sewerage Works Brought About by Waste—The Cost of Water and Sewer Service in Two Hypothetical Cities—Statistics of Canadian, U.S., and European Cities

Contributed by R. O. Wynne-Roberts, M. Inst. C.E., M. Can. Soc. C.E., F.R. San. Inst., Consulting Engineer, Regina, Sask.

A perusal of the technical press and of the papers and discussions at the various conventions of engineers will indicate that the subject of water consumption and waste is one of considerable importance.

That water is being wasted in cities is recognized by engineers, and that it cannot be completely eliminated is admitted by all. But the quantity which is used or wasted in excess of allowable or unpreventable waste, plus that actually consumed for all legitimate purposes, represents a tangible and potential source of wealth. The means by which such wealth can be conserved is dependent on the method adopted and the manner in which it is organized.

The influences which affect the consumption of water are the nature of the industries, the wealth and habits of the people, the extent to which water is used for fountains or other ornamental objects, watering of lawns, street sprinkling and other public purposes. Climate has also a very considerable influence, especially as to the amount used for sprinkling purposes, and that which is wasted in winter to prevent freezing. It is probable, however, that the most important factors in determining the consumption of water are the degree of care taken to detect leakage and other waste, and the fact as to whether the water is sold by measure or otherwise.[1]

Mr. R. O. Wynne-Roberts.

It will be assumed that the actual consumption of water on the North American continent is on a more generous scale, and that the climate as a rule is less humid and consequently the gardens and streets receive more watering than in Europe. This, however, cannot account for the great difference in the average consumption per capita.

While it is not always a sure method of comparison to consider the consumption in any one city with that of another, owing to the different conditions which obtain, when several cities are compared, the above statement loses some of its force.

On the following page there is a list of a few Canadian and American cities selected at random from references in various papers and reports.

Chicago has about the same population as Vienna, but the quantity of water consumed is over 15 times as great. Ottawa is about the same size as Devonport, but uses about 4½ times as much water. Montreal and Newcastle-on-Tyne are nearly similar in size, but Montreal uses 3½ times the volume of water used in Newcastle. Milwaukee and Frankfort-on-the-Maine have approximately the same number of inhabitants, yet the former uses three times the quantity of the latter. Basel, in Switzerland, and Buffalo, in New York State, are nearly alike in population, but Basel uses only one-eighth as much water. New York City, the greatest city of the West, requires 2½ times the quantity needed in London, Eng. The reader who will continue the comparisons will find material for thought and investigation. There are, of course, certain conditions in Europe which tend to keep the consumption low and these should be studied so as to arrive at a reasonable comparison. Such conditions are the number of faucets fixed on services, types of dwelling, methods of living, density of population in certain quarters, and so on.

In Germany, an allowance of 100 litres per capita per day is ordinarily considered ample for all city uses. This is equal to 27 U. S. gallons. Mr. Edward S. Coles, in a paper read before the American Waterworks Association in 1912, presented a list of British cities, the average domestic consumption in which was 29.8 U. S. gallons and the average trade consumption 13.6 gallons, or a total of 43.4 gallons daily per capita.

Even granting that the actual use of water for ablutionary and other purposes is more generous here than in European cities, it is palpable that the excess will not be great.

An American authority[10] estimates that the daily average for domestic purposes would be 25 gallons per capita, for commercial purposes 20, for public purposes 5, for loss 20 —total 75 gallons per capita.

There are many cities in the United States and Canada that are thriving on a smaller average. Domestic allowance of 25 gallons daily per capita is more than ample, and when it is borne in mind that a large number of industries, railways, etc., do not use city water, as a perusal of Cincinnati Sewerage and other Reports clearly shows, an allowance of 20 gallons per head per day for industrial consumption is high. The loss of 20 gallons is excessive, while the preceding allowances evidently include waste also.

The average consumption of the European cities cited is about 40 gallons per head per day. If this figure is increased by 25 per cent. it will represent a reasonable quantity and include unpreventable waste, which occurs in all cities.

The writer will for the purpose of this article assume two hypothetical cities, each of 250,000 inhabitants. One city will consume 50 gallons per capita daily, and the other 150 gallons. Approximate estimates, based on published statements which will be quoted, will be submitted to show the economics of waste. The water is supposed to be filtered, chlorinated and pumped 200 feet high or equivalent in pressure, and distributed. The sewage will be collected on the separate system and treated bacteriologically.

There is ordinarily one ratepaying consumer in every six inhabitants, so that in each city of 250,000 population there will be about 42,000 water consumers.

The daily consumption of water will average 250,000 × 50 = 12,500,000 gallons and 250,000 × 150 = 37,500,000 gallons. To these figures must, of course, be added an allowance in capacities of mains, pumps, etc., to meet the fluctuating hourly flows.

The waterworks of the six largest cities in Wisconsin[11] supplying an average of 81 gallons per head daily, cost about $187.25 per consumer, but eliminating one city, where the cost exceeded the average by nearly 100 per cent., the mean of five cities was $151.42 per consumer. Accepting this as the basis of cost, the water-works system for a city of 250,000 inhabitants, or 42,000 consumers, will be about $6,360,000. It is therefore reasonable to estimate that for 50 gallons per head daily the cost will be about $6,000,000 and for 150 gallons per head $7,000,000. The extra $1,000,000 will annually cost 5 per cent. for interest and say 2½ per cent. for depreciation, a total of $75,000 per annum.

The cost of pumping water will be about six cents per million foot gallons,[12] so that 12.5 million gallons raised 200 feet will cost about $54,750, whereas 37.5 millions raised to the same height will cost $153,250, an extra cost of $109,500 per annum. The average cost in 21 cities in Wisconsin in 1911 was $16.70 per million gallons pumped. On this basis the annual cost would be $76,000 and $228,000 respectively.

Filtration and sterilization will cost about $3.37 per million gallons,[13] to which is added the cost of pumping into filters, making a total of $3.50. So that in the first city this work will cost about $16,000 and in the second $48,000—a difference of about $32,000 per year.

The distributing mains sufficient for domestic, industrial and fire purposes should satisfy the National Board of Fire Underwriters' standard (1910) and also allow for the usual maximum fluctuations in consumption.

The National Board of Fire Underwriters' general requirements may be expressed by the following equation:

$$Y = 1020 \sqrt{X}\ (1 - 0.01 \sqrt{X})$$

Y = gallons per minute. X = population in thousands.

The cities under consideration have about 250,000 population, so that to satisfy the above requirements

$Y\ 1020 \sqrt{250}\ (1 - 0.01 \sqrt{250} = 13{,}570$ gallons per minute.

The consumption of 12,500,000 gallons per day is equal to an average of 8,700 gallons per minute and 37,500,000 gal-

Statistics of Canadian, U. S., and European Cities

City	Province or State	U.S. Gallons per capita	Population	Source of Information
St. John	N.B.	250	42,500	Canadian Commission of Conservation
Vancouver	B.C.	164	120,000	Canadian Commission of Conservation
Halifax	N.S.	260	46,600	Canadian Commission of Conservation
Quebec	Que.	161	78,200	Canadian Commission of Conservation
Hamilton	Ont.	148	81,000	Canadian Commission of Conservation
Ottawa	Ont.	229	87,000	Special Committee Report
Toronto	Ont.	120	450,000	Canadian Commission of Conservation
Montreal	Que.	[illegible]	555,000	Hering & Fuller Report, 1910
New York City	N.Y.	111	4,800,000	(2)
Buffalo	N.Y.	321	425,000	(2)
Chicago	Ill.	[illegible]	2,200,000	(2)
Philadelphia	Pa.	205	1,600,000	(2)
Milwaukee	Wis.	115	410,000	1913 Report
Kansas City	Mo.	126	[illegible]	1913 Report
Cincinatti	O.	[illegible]	392,000	1913 Sewerage Report
Pittsburg	Pa.	197	550,000	(2)
St. Louis	Mo.	[illegible]	687,000	(2)
Cleveland	O.	162	560,000	Toronto 1912 Report
Detroit	Mich.	[illegible]	[illegible]	(2)
Baltimore	Md.	[illegible]	560,000	(2)
St. Paul	Minn.	61	240,000	
New Orleans	La.	53	[illegible]	1913 Report
Boston	Mass.	[illegible]	733,000	1913 Report
Albany	N.Y.	[illegible]	104,000	Engineering Record, Aug. 3, [illegible]
Salt Lake City		400		Engineering Record, July 26, [illegible]
	The following are the statistics of a few European cities:			
Vienna	Austria	[illegible]	1,800,000	[illegible]
Aachen	Germany	[illegible]		[illegible]
Frankfort-on-Maine	Germany	[illegible]	[illegible]	[illegible]
Wiesbaden	Germany	[illegible]	[illegible]	[illegible]
Hamburg	Germany	[illegible]	757,000	[illegible]
Munich	Germany	[illegible]	[illegible]	[illegible]
Berlin	Germany	[illegible]	[illegible]	[illegible]
Basel	Switzerland	[illegible]		[illegible]
Copenhagen	Denmark	[illegible]		[illegible]
London	England	43	[illegible]	[illegible]
Liverpool ...	England	36	960,000	[illegible]
Newcastle-on-Tyne	England	[illegible]	590,000	[illegible]
Hull	England	[illegible]	[illegible]	[illegible]
Manchester ...	England	[illegible]	[illegible]	[illegible]
Devonport ...	England	31	[illegible]	[illegible]
Glasgow	Scotland	[illegible]	[illegible]	(6)
Nuneaton	England	21	[illegible]	[illegible]
Stirling	Scotland	[illegible]	28,000	[illegible]
Plymouth	England	[illegible]	152,500	[illegible]
Sydney	Australia	[illegible]	[illegible]	[illegible]
Riga	Russia	[illegible]		(4)
Weardale and Consett	England	[illegible]	[illegible]	[illegible]

lons daily represents an average of 26,000 gallons per minute, but the maximum rate will probably be about 150 per cent. of the average. Therefore the relative requirements of the two cities will be as follows:—

	No. 1 City	No. 2 City
Fire purposes	13,570	13,570
Domestic and industrial purposes.	8,700	26,000
Add 50% for max. hourly demand.	4,350	13,000
Total gallons per minute	26,620	52,570

In other words, the capacity of the mains in the city No. 1 will be only one-half of that in No. 2.

According to published statistics[14] distributing mains absorb about 64 per cent. of the total capital expenditure. There are other published figures which conflict with this percentage, but as the above result was evidently obtained by careful analysis of at least 22 different city waterworks, it may be taken for granted that it is reliable. The cost of the distributing mains in No. 1 city will therefore be about $3,840,000 and in No. 2 about $4,480,000 and additional expenditure of about $640,000. The cost of operating distribution works may be estimated at $2.50 per million gallons pumped[15] which in the first city would amount to about $11,400 and in the second to about $34,200—a difference of $22,800 per annum.

After having distributed the water to the people, the city must also provide sewers to drain it away after use or misuse. The lateral sewers are, of course, designed for flows which, normally, will only partially fill the pipes. The trunk sewers must be calculated so as to be ample to accommodate the districts served.

Supposing it were necessary to provide one main conduit to the outfall works, that the grade were 1 in 5,000 and that no ground water were admitted, the diameter of such a sewer to convey 12.5 million gallons per day would have to be about 54 inches and for 37.5 million gallons 82 inches. This does not take into account the hourly fluctuations, otherwise the diameter would have to be larger in each case. Accepting Cincinnati prices,[16] the cost of these conduits would be:

54-in. Diameter Sewer

Trenching 8 yds. at $1.25	$10.00
Concrete, 1.38 yds. at $15.00	20.70
Cost per foot run	$30.70

82-in. Diameter Sewer

11.3 yds. at $1.25	$13.95
2.24 yds. at $15.00	33.60
	$47.55

That is, to convey three times as much sewage as would be required economically, the ratepayer would have to pay about 60 per cent. more in capital expenditure (and, of course, in annual taxes for interest and maintenance) on such trunk sewers. When the costs of vitrified pipe sewers are analyzed, it will be found that the extra cost for sewer laid to carry, say, 1,200 gallons per minute and 3,600 gallons per minute will be in the following ratio:—

15-inch pipe, grade 1/600

Vitrified pipes	.75
Trenching 10 feet deep	.70
Total per foot run	$1.45

24-inch Pipe, Grade 1/800

Vitrified pipes	$2.00
Trenching 10 ft.	.70
	$2.70

The extra cost is 86 per cent., so that the additional cost to convey three times a given volume of sewage increases as the diameter of the sewers diminishes. The cost of sewering a city is probably about the same as to provide water mains, perhaps more, because water mains operate under pressure and sewers by gravity; the former are always full, while the latter are generally only partially full and consequently larger in diameter or dimensions. Many of the lateral sewers could not be reduced in size even if the water consumed were maintained at 50 gallons per capita, but many of the larger sewers could, and the saving in capital expenditure would be tangible.

The next item of expenditure is for sewage disposal works. Whilst to some degree, it is true that an extravagant use of water does not necessarily entail the construction of works to treat sewage in proportion to the flow or volume, it nevertheless means works of a greater capacity than would be necessary in the case of an economical water consumption, for tanks and pumps must be in some relation to the hourly quantity of sewage. The capacity of the pumps (if any) must be more than equal to the maximum hourly flow of sewage, with reserve pumps and power as well, in case of breakdowns or other contingencies common to such plant. The velocity of the flow of sewage through the tanks must not for long periods exceed a critical limit. To attain this condition it is evident that tanks capable of treating 37.5 million gallons daily will be much larger than would be necessary for a discharge of one-third that volume.

Mr. George M. Wisner in his report[17] supplies an interesting table of costs which is copied below:—

Type of tank	Nominal period of settling	Gallons per capita	Cost per capita
Emscher	3 hours	200	$1.44
Dortmund	4 hours	200	$0.84
Straight flow	8 hours	200	$0.77
Straight flow	6 hours	200	$0.58

As Emscher or two-storey tanks are now prominently before us, its estimated cost per capita will be provisionally accepted. To maintain the same velocity for 150 gallons per capita daily, the cost will be

$$\$1.44 \times \frac{150}{200} = \$1.08 \text{ and for 50 gallons per day } \$1.44 \times \frac{50}{200} = \$0.36.$$

The writer does not contend that the cost of these tanks will be in strict proportion to the flow of sewage, as there are items of expenditure which are not proportionate; still, taken as an entity, the cost will not seriously exceed the above. Mr. Clark when discussing a plant in course of construction in Baltimore, stated that the detention period with Emscher tanks would be two hours[18]—the ordinary standard detention period—consequently to maintain this detention period as closely as possible the number or sizes of the tanks must in the cases under present discussion be approximately in the same ratio as to dimension and cost. But to allow for contingencies, assume that the cost would be $1.10 and $0.40 respectively per capita, then, 250,000 × $1.10 = $275,000, and 250,000 × $0.40 = $100,000, a difference of $175,000, which at 5 per cent. interest and 2 per cent. maintenance, etc., means $12,250 per annum.

Perco-filters again are designed to deal with about 2,000,000 gallons per acre daily. The Columbus filters were designed for this rating. Mr. George W. Fuller states in his book that his practice has been to specify for average conditions, a 6-foot filter at an average rate of two million gallons per acre per day.[19] This would be for a sewage flow of separate sewers approximately 100 gallons per capita daily. It is contended that perco-filters will deal with approximately the same quantity of organic matter per acre per day, regardless of the degree of dilution—in other words, the organic matter from a residential city will, in the aggregate, amount roughly to the same quantity whether it be contained in a large or small volume of water. The British Government (Local Government Board) ordinarily requires in the case where there is no land for subsequent treatment or a large river for effective dilution, a filter 6 feet deep and one acre in area for each million gallons of sewage dry weather flow, but when, as is the practice in America, a river is available for the ultimate oxidation of the filtrate, then the area is about one-half. It is therefore reasonable to postulate that for a consumption of 50 gallons per capita daily the area of filter will be about one acre per million gallons and for 150 gallons per day an area of one acre for each two million gallons, on which basis the respective areas will be about 12½ and 18¾ acres. A reserve must be added—say, ten per cent.—which will increase the areas to 13.75 and 20.625 acres. Mr. Wisner estimates the cost of perco-filters at about $28,000, while according to the experience of other cities the average was about $38,000.[20] Basing the cost at $30,000 per acre the first case will require an expenditure of $412,500 and the second $618,750—a difference of $206,250, which at 5 per cent. interest is equivalent to an annual burden of $10,312. The cost of operating and maintaining these filters may be placed at $2.00 per million gallons.[21] This will amount to 12.5 × 365 × 2 =$9,125 and 37.5 × 365 × 2 = $27,375.

Sterilization of the filtrate by hypochlorite of lime costs about $1.67 per million gallons treated,[22] when 4½ parts of available chlorine per million parts are applied. This for the first case would mean $7,620 and in the second $22,860.

Summarizing the items already mentioned in the foregoing observations, the following results are obtained:

	No. 1 city consumption 50 g.p.c.d.	No. 2 city consumption 150 g p.c.d.
Interest and depreciation on total capital on waterworks, per annum	$450,000	$525,000
Annual cost of pumping	54,750	153,250
Annual cost of filtration and sterilization	16,000	48,000
Annual cost of distribution works..	11,400	34,200
Total on waterworks	$532,150	$760,450
Annual cost of operating sewage tanks, plus interest	$ 7,000	$ 19,250
Annual cost of operating perco filters plus interest	29,750	58,312
Sterilization of filtrate	7,620	22,860
Total	$44,370	$100,420

Adding the two expenditures together we arrive at a rough idea of what it means to the ratepayers:

	No. 1 City	No. 2 City
Waterworks	$532,150	$760,450
Sewer works	44,370	100,420
Total cost	$576,520	$860,870

The difference of $284,350, capitalized at 5 per cent., will represent a decent sum of $5,687,000.

The writer has advisedly adopted published figures and in doing so has quoted the authorities, but it is manifest that the above estimates serve only as indications, and therefore each city must be considered separately, although the foregoing statistics answer as direction posts to those who will analyse carefully the financial results to be obtained in their own cities. The foregoing will afford a sufficiently safe basis to warrant a close scrutiny into the relative cost to the ratepayers of an economical versus an extravagant consumption of water. Furthermore, in those cities where the water supply is controlled by companies, the foregoing observations will suffice to show what waste means to them, and to their customers. The dividend-producing power of any franchise depends on an efficient management and this in its turn means the stoppage of all preventable waste.

Sources of Information

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[4] Hutte Engineers' Pocket Book, 1911.
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[6] American Waterworks Association Proceedings, 1912.
[7] Proceedings Institution of Municipal & County Engineers, Vol. XXXVIII.
[8] Proceedings Institution of Municipal & County Engineers, Vol. XXXVII.
[9] Proceedings American Waterworks Association, 1911.
[10] Water Supplies, Turneaure and Russell, page 22.
[11] Wisconsin Railroad Commission Report, 1911, p. 453.
[12] Wisconsin Railroad Commission Report, 1911, page 453.
[13] Fuller, Baltimore Works, Engineering Record, May 9th, 1914.
[14] Proceedings American Waterworks Association, 1911, page75.
[15] Wisconsin Railroad Commission Report, 1911, page 445.
[16] Report on a Plan of Sewerage, Cincinnati, 1913, page 252.
[17] Report on Sewage Disposal Sanitary District of Chicago, 1911.
[18] Engineering Record, July 4th, 1914.
[19] Sewage Disposal, George W. Fuller, 1912, page 697.
[20] [21] Engineering Record, August 22, 1914.
[22] Report on Plan of Sewerage, Cincinnati, 1913, page 567.

A dam 325 feet long between abutments has been built at Fenelon Falls, Ont., for the Dominion Government, by Messrs. McPhee & Kehoe, of Brechin. The structure takes the place of an old wooden dam which was in service for many years. There are twelve large reinforced piers with grooves for holding the stop-logs. A track provides for conveying the machinery necessary for adjusting the stop-logs. The total cost of the work has been approximately $55,000

The harbor works at St. John are being pushed with the greatest vigor in anticipation of an increased traffic in grain and other food stuffs between Canada and Great Britain this winter. The new pier, which will probably be utilized by the steamers of the Canadian Pacific Railway, will be ready for business on the first of December. A large warehouse is now in course of erection, and an elaborate scheme of reclamation is being carried out with a view to providing enlarged trackage facilities.

The following is the 1914-15 programme of the Canadian Society of Civil Engineers. The meetings will be held at the Society's headquarters, 176 Mansfield Street, Montreal: October 22, general section meeting; November 5, monthly meeting; November 19, electrical section meeting; December 3, mechanical section meeting; December 17, monthly meeting; January 7, mining section meeting; February 4, monthly meeting; February 18, general section meeting; March 4, monthly meeting; March 18, electrical section meeting; April 1, mechanical section meeting; April 8, monthly meeting; April 22, mining section meeting. Mr. Walter J. Francis is Chairman of the Committee on Meetings.

There is further trouble with the proposed new building by-laws for Montreal, and the adoption of a new code is still a long way off. More than two years ago the drafting of the code was put into the hands of a committee representing the architectural, engineering, and contracting interests, and in turn the duties were delegated to Messrs W. J. Francis and J. Venne. These gentlemen, after many sittings and the lukewarm support of the City Council, drafted a number of by-laws, which it is understood were sent direct to the Council without being referred to the general committee. The Council asked the law department to study the code, and this entailed further delay. The City Attorney's report is to the effect that the proposed new code will require revision to weld it into a harmonious whole. The matter has been referred to the Legislation Committee of the Council.

The Efficient and Inoffensive Treatment of Sewage[*]

By Rudolph Hering, D.Sc., C.E.

SINCE the introduction of water supplies into cities the subject of sewage treatment has become an important one in many cities. The water as it passes through the city receives the dirt, dust, and excremental discharges from our houses and, together with rain water, also the dirt and dust that has accumulated upon the streets, roofs, etc. We have turned the clean water furnished us into dirty water, then called sewage, which is discharged into sewers and reaches the nearest watercourses and, with them, finally the ocean.

Dr. Hering.

As cities grew and the watercourses were small their water frequently became offensive. The heavier matters were deposited in the streams as sludge and putrefied, while the flowing water was deprived of its dissolved oxygen, and both sludge and water became offensive.

It was found later that diseases were caused by certain bacteria which were discharged from our bodies while sick, and entered the sewers and the streams. Sometimes these germs became free and infected the air, or the polluted water was used in such ways that the germs entered human bodies and made them sick. Gradually, therefore, the sewage question became not only one of convenience of city life but one of health.

The first serious troubles were experienced in England, where the communities are crowded and the rivers are small. England had also been the first country to generaly introduce modern water supplies into houses. Many of its rivers soon began to get foul and sometimes dangerous to health. Therefore the subject of sewage collection and disposal received most attention and the first satisfactory solutions in England.

To-day we have reached the conclusion in all civilized countries that it is practicable and economical to collect sewage from houses and cities, and to carry it away underground in sewers, to be delivered either into flowing streams or onto land in such ways that it will neither become a nuisance nor be of any injury to health.

We can now design the house sewers or drains and the receptacles of the waste water in such a way that by cleanliness and proper ventilation we need not have a nuisance in the house nor give disease germs in the sewage an opportunity to enter the same. We can now design the city sewers in a way so that they can carry the sewage or dirty water from the houses to the outfalls without causing any nuisance or danger to health on the streets.

There are many cities, particularly in Europe, where there is no offensive odor within the sewers. In Paris, Hamburg, Wiesbaden, and other cities even visitors regularly inspect them who desire the sensation of passing through these waste-water channels under the streets. I feel satisfied that it is only a question of time when in all cities we shall have our sewerage systems so built and maintained that no more offence will arise from them than we now expect in our bathrooms, water-closets, or kitchens.

When the sewage from the house gets into the sewer it consists of liquids and solids. At first nearly all of the matter which is liable to become offensive is in solid form. The sewage can be strained when leaving a house, and the liquid on standing will rarely, if ever, become foul, because whatever little dissolved organic matter it may contain is oxidized by the large quantities of dissolved oxygen. As the sewage runs on the solid matter is more and more dissolved. After a mile or two, and generally at the outfalls, we find that about one-half of the waste organic matter is in solution. After flowing many miles a still larger part is dissolved.

It is important to realize this last fact, because the question of sewage disposal and treatment is very much dependent upon the physical condition of the sewage and whether there is much organic matter in solution or not.

The nuisance resulting from sewage is caused by the gradual exhaustion by this matter of the oxygen dissolved in the water. Organic matter as it decomposes first consumes oxygen, and when the latter is all gone an entire change takes place in the process, and hydrogen is then consumed. The first process we call putrefaction, and it is quite offensive. It is the condition which we have tried to prevent and can now prevent, knowing better than formerly the conditions under which it occurs.

Both oxidation and putrefaction are accomplished by the action of bacteria, which fact, as it concerns sewage, has been known only for the last thirty or forty years. Since the discovery of bacterial action in converting dead organic into mineral matter we utilize two classes of bacteria for this purpose. One class is that of the aerobic bacteria which cause oxidation in the presence of oxygen; the other class is that of the anaerobic bacteria which live in the absence of oxygen. We are concerned, however, with two orders of anaerobic bacteria. One produces putrefactive or offensive conditions, the other does not. This fact has been applied to sewage treatment only within a few years. The latter kind are not putrefactive; they decompose the sewage without oxidation and yet do it in an entirely inoffensive way. Offensiveness is caused by the production of bad-smelling gases, of which the principal one is sulphuretted hydrogen. We can now prevent the development of sulphur bacteria, which produce this gas, by creating conditions which allow other bacteria to develop which marsh gas and carbon dioxide, neither of which is offensive. In the modern methods of sewage treatment we therefore endeavor to utilize the aerobic bacteria, and, of the anaerobic bacteria, chiefly those which produce marsh gas and carbon dioxide. This practice constitutes the greatest progress we have made in sewage treatment during the last few years.

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[*] Extracted from a paper presented at a meeting of the Mechanical and Engineering Sections of the Franklin Institute.

We can now say that the entire process of sewage collection and disposal, from start to finish, can be conducted inoffensively. We do not hesitate, as we did less than fifty years ago, to have a bathroom next to our bed or living-room. The kitchen sink has less odors than formerly. Street sewers in many cities are no longer offensive.

We have not yet advanced as far as this in all street sewers, particularly in our country, because they are not all properly built nor cleaned. The suspended matter carried by the sewage is frequently retained either by deposit or by the roughness of the sewer lining or by eddies formed, where the flow is not regular. In such cases where the retention is more than a day the dissolved oxygen becomes exhausted and putrefaction begins. To prevent this retention the sewage must have a steady and regular flow and rapid velocities, and the interior surface against which the sewage flows must be as smooth as practicable. All the progress in city sewerage that has been made in the last fifty years has been along these lines, so that as a result thereof the sewage not only is devoid of odors in the sewer but is delivered at the outfall with a remnant of dissolved oxygen and without putrefaction. In fairly good-sized towns properly sewered and where the sewers are kept clean I have never observed at the outlet anything worse than a stale odor.

To get this result we should also have proper means of flushing the sewers, and also of well ventilating them so that they contain fresh air at all times. The oxygen of the air replenishes what is being exhausted by decomposing matter in the water and by the temporarily stranded matter along the sides. In Europe it is customary to flush the smaller sewers once or twice a week, the larger ones once or twice a month. In our country we do not yet flush the sewers as much as we should, and in most cities the flushing is left to the rain-water which enters occasionally. Rain-water flushing may prevent serious deposits, but it will not prevent temporary deposits which produce the objectionable odors. Small sewers are flushed by automatic flush tanks, which generally keep the smaller sewers in a better condition than the larger ones.

Flushing and ventilating not only prevent nuisance but also help to remove disease germs. Ventilation either tends to desiccate them or to scatter them by dilution to points where they are likely to perish. Flushing carries them away to the outfall. A large number of pathogenic bacteria connected with typhoid fever and diarrhoeal diseases are doubtless contained in sewers. Yet careful inquiries made in Europe and here have not resulted in the discovery of a single case of typhoid fever or dysentery which could be directly traced to sewer air where sewers had been kept clean and fresh.

Sewers were first introduced for the purpose of carrying away rain-water. It was only a second thought to carry away also the waste water from the houses through the introduction of the so-called water-carriage system of sewage removal. The method of uniting the sewage and rain-water in the same channel has caused what is known as the combined system of sewerage.

In recent years it has frequently been found more economical to carry the dirty water or sewage away by a separate system of pipes, and the rain-water by another system. An economy results from the fact that in building up town areas we are generally more concerned at first in removing the dirty house water in pipes than the street water, and are willing to let the latter run off on the surface so long as no trouble is caused thereby. When the latter becomes objectionable, then it often happens that much shorter drains are required, because the rain-water is comparatively clean and can be discharged into any near brook, while the sewage must be carried farther away and perhaps must be treated. Sometimes a city has both systems, as, for instance, Philadelphia, where the combined system is used for the largest part, but where in the suburbs there are sections where the separate system has been preferred as being less expensive.

The separate system is generally preferred where the sewage must be treated in some way, and where it must be pumped. Should there be a large amount of rain-water mixed with the sewage, the treatment and the pumping become expensive.

The question has frequently been raised as to whether or not the first flow of the rain-water, which generally carries manure and dust from the streets of a city and a great many bacteria deposited upon the street surface, should be carried into the sewers or kept separate in the storm-water drains. Dr. William Dunbar, of Hamburg, very carefully determined the condition of the street water at the beginning and at the end of a storm. He found that at the beginning the water was as foul as the sewage in the sewers. It is very desirable, therefore, if it can be practically done, that in the case of a separate system the first wash from the streets be taken into the sewers, so that it can be treated with the sewage. This expedient is followed in some cities in Europe, and I think that in the future it will be followed more frequently in our country than heretofore.

Another most important part of a city sewerage system is the final disposal of the sewage. This should be accomplished in a manner so that it will not be harmful nor unpleasant. We should, therefore, soon determine upon a place of final discharge and a method of treatment to which it should be subjected.

Such a treatment may be complex. We have to consider disease germs on account of the danger to health, and the putrefying matter so far as a nuisance is concerned. We have further to distinguish between the most economical ways to prevent both of these troubles.

One part of the sewage is solid matter in suspension, and the other part is liquid matter together with fine suspended matter which will not readily settle out but remains in the liquid and causes it to be more or less turbid.

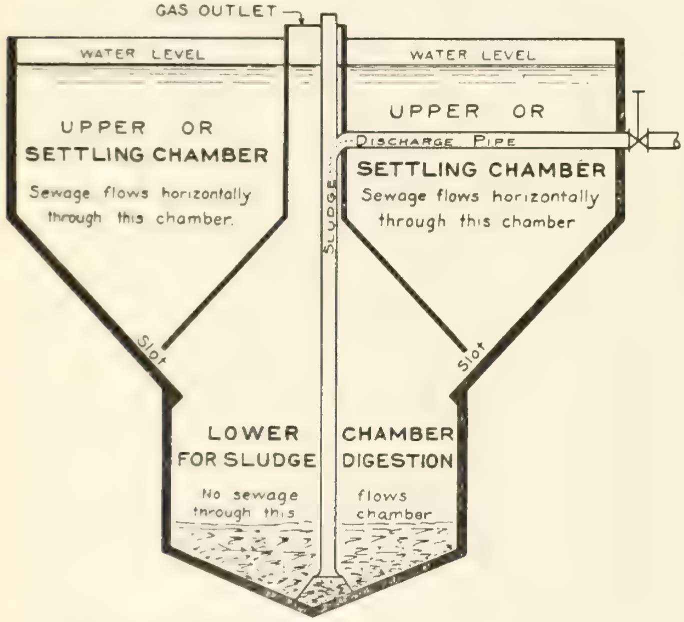
For the purpose of any subsequent treatment it is best to divide the sewage into these two parts by cause the treatment of the solids demands an entirely different process from that of the liquids.

The first thing to be done, therefore, when sewage is to receive any treatment, is to allow the suspended matter to be held back and separated from the liquid matter, so far as this is practicable.

The collection of the solid matter is accomplished by screens and by sedimentation. Many sewers, when they discharge into rivers, have screens near their outfalls causing the larger matters to be retained, taken out, and separately disposed of. Sometimes this matter is pressed, squeezing out much of the liquid, and the remaining matter is either buried or burned.

Where screening is not adopted there is no way of keeping out the floating matter, except by retaining the sewage in large basins in which the floating matter gathers at the top and from where it can be removed at the surface. The retention of the sewage also causes the heavier matters to deposit.

When the oxygen in the sewage is exhausted the deposited matter or sludge begins to putrefy, and the evolution of gases causes the entire mass of sewage and sludge to become putrescent or septic and emit strong odors. Many studies have been made and perhaps a hundred patents have been taken out relating to the treatment of this sludge so that the results would be acceptable both from the standpoint of cost and nuisance.



Vertical section through Imhoff tank at right angles to the direction of sewage flow.

The most common treatment has been to put the sludge upon fields, where it was dried, ploughed in, or covered with lime, etc. It has also been pressed, mixed with strong fertilizers or pulverized and used as manure.

In order to have a more complete removal of the suspended matter from the sewage, lime was added to the water. The resultant sludge, increased in quantity, was then usually dumped or pressed into solid cakes, for use as fertilizer.

All the processes of treating sludge were, however, not very satisfactory because of the resulting stenches. Yet they had to be recommended as the best known expedients, and on account of the offensive odor it was necessary to locate the treatment works far away from the inhabited parts of the cities. Only a few years ago the city of Baltimore bought a strip of land about 1,000 feet wide outside of its works in order to obviate any nuisance.

About eight years ago a German engineer erected some experimental plants at Essen, modelled after the experience gained at the sewage fields near Hampton, England, where Dr. Travis had been making some promising studies. The Essen experiments, undertaken by Dr. Imhoff, resulted in the discovery of a means of securing a collection and a treatment of the sewage sludge that was not offensive.

This process is now known as that of the Imhoff tank treatment, varying the process from that used at Hampton, by preventing any circulation in that part of the tank where the sludge is deposited and where it ferments, Dr. Imhoff has succeeded in establishing a decomposition confined to the biological action of such classes of bacteria which develop substantially only marsh gas and carbon dioxide gas, neither of which has an odor.

It is known that if no fresh sewage flows over decomposing sludge, to supply it with miscellaneous sewage bacteria, the controlling bacteria in the sludge are confined substantially to but two classes; namely, those producing the two inoffensive gases just mentioned.

The Imhoff tank consists of practically two tanks, one over the other. Through the upper one the sewage flows with a velocity reduced so much that its suspended matter will settle. It requires a passage through the tank of from 1½ to 2½ hours. This matter is allowed to slip through a slot into a lower chamber in such a way that no possibility exists for any solid matters to rise and again mix with the fresh sewage passing by in the upper tank. There are special shafts provided for the ascent of any fat or light matter, which should rise with gas bubbles from the lower chamber, and to form a scum in the shaft, to be removed when necessary. This scum is usually small in amount and could be readily removed if it becomes excessive. It has no objectionable odor in any of the existing plants.

The accumulating sludge in the lower tank, when it has become ripe and the existing bacteria have been practically exterminated, has no odor. This can be found by extracting some of it from different depths. According to the character of the sewage, it requires about three to five months to be decomposed sufficiently so that it will not become putrescent when again exposed to the air. The decomposed sludge is withdrawn from the bottom of the tank automatically, and, being deprived of its slimy, putrescible matter, it is friable and porous, looking very much like garden soil, to which it is very similar. The latter has been formed from the leaves and branches without putrefaction and with the evolution of the same inoffensive gases, such as marsh gas and carbon dioxide, which produces the decomposition in the Imhoff tanks. It rapidly drains out its superfluous water, and dries in well-drained beds within a week sufficiently to be spaded and removed.

There are over one hundred plants in operation in Germany and this country, and reports indicate that in none of them which are properly operated does the sludge have an offensive odor. In America the largest plant is in Atlanta, Ga., and there is one at Holmesburg, Philadelphia, below the Torresdale Water Filtration Plant.

It is gratifying, therefore, that we have now a means of treating the sludge so that it will not be offensive, and we believe that by the same process the disease germs contained in the sludge will have perished by the time it is extracted and dried.

Before sewage reaches the tanks it is advisable, particularly where the sewage contains street wash, to take out any gravel or sand (i.e., grit). This deposition is secured in a special small chamber where the velocity of the sewage is reduced to about 12 inches in a second. This reduction will cause the grit to deposit and the rest of the suspended matter, which contains the foul matter, to pass on to the settling chambers. In these tanks the velocity is much more reduced, generally to about one-tenth inch per second. This comparatively quiescent state causes the deposition of practically all of the foul suspended matter which forms the bulk of the sludge. We use the term "settleable" matter because there is not deposited the fine suspended matter which may cause putrefaction and which must be treated together with the dissolved organic matter.

In order to increase the quantity of settleable sludge, experience has shown that by adding a precipitant to the sewage a large percentage of this fine matter and even some of the dissolved matter can be coagulated and also settle into the lower tank. In the latter case the effluent sewage is much clearer, but the size of the lower tank must be correspondingly increased on account of the added sludge and precipitant. It is, of course, a question to be determined in each case as to whether or not it is necessary or wise to add a chemical precipitant.

You have all heard of the septic tank. This was first used under this name in the city of Exeter, England, and it was found that in a single basin where the sewage was retained at least eight hours most of the suspended matter was deposited on the bottom and underwent putrefaction. It was allowed to remain in the tank until fairly well rotted out, which generally took at least a year.

This was a process of putrefaction which produced chiefly sulphuretted hydrogen, and, therefore, not only the liquid but also the putrefying sludge sent up bubbles of offensive gas. Notwithstanding this fact, septic tanks have been very extensively used on account of their relative economy as compared to other processes, and it was even heralded as the long-expected final solution of the sludge question. A good deal of the sludge disappeared, so that in a few cases but ten per cent. of the original quantity was left; in most cases the record is from 25 to 50 per cent. The reduction in the quantity of sludge handling was the chief attraction of this process.

On account of the odor septic tanks were isolated and kept far away from inhabited sections of a city. In the city of Saratoga, N.Y., there is a well-devised system of sewers and of sewage treatment, with possibly the best installment of a septic tank in this country. The odor from the tank, however, is very strong. In one of the suburbs of Berlin (namely, Wilmersdorf) septic tanks are also used with similar results. The odor from the tanks was found to be perceptible over a mile away.

We cannot place much reliance on the figures given as to the reduction of the sludge, because so much depends upon the amount of water contained therein. If we have originally 95 per cent. of water in the sludge and reduce the same to 90 per cent. we have diminished the quantity of sludge practically one-half. This fact makes it necessary, when comparing quantities of sludge, to compare also their percentages of water.

The sludge of the septic tank is of a different character from that of the Imhoff tank. It is not as thoroughly decomposed, generally retains a large amount of fine and slimy matter with a large amount of water, and after withdrawal does not become spadeable sometimes for several months.

The last subject to be mentioned is the treatment of the liquids after they have been freed from the settleable suspended matter by passing through the tanks. There are still generally left a substantial amount of fine suspended particles and a large amount of dissolved organic matter. The oxygen contained in the water is rapidly extracted.

If the sewage is discharged into a running stream, and if there is enough oxygen in it to oxidize its organic matter, a decomposition of the organic matter will take place in the water. This method of oxidization in running streams is a practicable and legitimate means of oxidizing liquid sewage. It is just as rational as an oxidation on land. We are, therefore, not justified in seeking the entire exclusion of all sewage from rivers where they can be utilized for oxidation, both economically and without offence.

We must not forget, however, that nuisance is not the only question to be considered. We must prevent also all objection due to the injury of fish and shell fish and to a possible danger from bathing, and in no case can such water, which has received sewage, be used for drinking purposes, unless it is first purified. We must also not forget that river water may be polluted as much from the natural land washings and city washings during a rain storm as from liquid sewage.

Nearly all of the large cities of the world dispose of their sewage by river dilution. In some cases this process is not properly carried out; the solid matter of sewage is admitted in too large proportions, and sludge remains in the rivers by sedimentation. Sometimes, also, more liquid sewage is discharged than can be properly oxidized by the water. Yet, after the floating matter and sludge have been removed, before sewage is discharged into a river, and if the river contains enough oxygen, there can be no objection to utilizing nature's means of purifying organic waste matter in this very economical way.

If there is no river, or if the river is not large enough to promptly dilute the amount of sewage in question, and if there is trouble anticipated regarding fish life, then it is necessary to purify some and often all of the sewage on land.

There are many processes of such purification on land which have been tried, particularly in England. It will not be necessary to mention them all, because most of them have been abandoned. To-day there are really but two processes in use: a treatment by coarse-grained filters and a treatment by sand filtration.

The coarse-grained filters are built of material from the size of a walnut to the size of a fist, and of depths varying from 5 to 10 feet. The sewage is delivered upon the top in various ways. In all cases it must be sprinkled either from stationary or moveable jets, because otherwise the large pores of the bed would let it rapidly run through. The sewage percolates through the bed by slowly flowing on the surfaces of the grains from one to the other until it reaches the bottom. Upon these grains or stones is a slimy coating which harbors myriads of bacteria. These take from the passing sewage the organic matter which is in solution and convert it into inoffensive and inert matter. While the water may be quite putrescible when sprinkled on, it leaves the filter, if this is properly devised, without putrescibility, i.e., in a condition so that it will not become foul.

The process of sand filtration is virtually the same as just described. The grains are much smaller and, therefore, the liquid can flow directly upon the bed for distribution instead of being sprinkled. The speed of percolation is much slower and, therefore, the purification is greater. Bacteria do the converting in both cases.

Both coarse and fine-grained beds are underdrained to allow of a free discharge of the effluent, and both should have a free circulation of air between the grains to supply the oxygen which is necessary to convert organic matter.

Costs and Methods of Building Large Sewers*

By H. R. Abbott†

PRACTICALLY all of the work described in this paper—which deals with construction methods and costs for large concrete and brick sewers—is built in good stiff blue clay, in the Sanitary District of Chicago. The improvements are all of recent date—some are still unfinished—and include 12 x 14-ft. plain and reinforced concrete sections on West Thirty-ninth Street, 7-ft. and 7½-ft. brick sewers and reinforced concrete conduits as large as 16 ft. in greatest dimension, on South Fifty-second Street. The total length of the sections described is about 17,600 ft.—10,000 ft. in brick, 5,320 ft. in plain concrete and 2,280 ft. in reinforced concrete. The latter part of the article is devoted to a discussion of cost-keeping methods. All the tables given cover field operations only, but overhead charges are discussed in the concluding portion of the paper.

West Thirty-ninth Street Conduit

One conduit, 12 x 14 ft. in size, of elliptical section, was built in West Thirty-ninth Street, from Western Avenue to Robey Street; thence south to the west arm of the south fork of the Chicago River. The total length is 2,346 ft., of which 1,868 ft. are plain concrete and 478 ft. reinforced concrete, the reinforced section being under railroad property. Connection was made at Western Avenue with a conduit of similar section, extending north in Western Avenue to the main channel of the Sanitary District. The conduit was designed to discharge from 100 to 200 cu. ft. per second. It has a 1:1,000 grade, and the flow line is about 3 ft. below crown.

Excavation was started at the Western Avenue end in open cut. A Bucyrus 70-ton steam shovel, with a 1¾-cu. yd. dipper, was mounted on five 16 x 18-in. timbers, 30 ft. long, with two 2-in. truss rods to each timber. The trench width was 15 ft. 8 ins. and the average cut 23 ft. 6 ins., making an excavation of 13.7 cu. yd. per running foot. On account of the deep cut, the shovel was equipped with a 36-ft. boom and a 54-ft. dipper handle. As there was liability of slides and cave-ins, the excavation was handled in two lifts. On first run the shovel excavated the top 10 ft., using 9-ft. sheeting with one set of bracing placed about 6 ft. below the ground surface. The shovel dug ahead of the finished cut from 75 to 100 ft., then backed up and excavated the lower 13½ ft. The lower lift was taken out between steel beams, each built up of two 10-in. I-beams with cover plates, 50 ft. long, held in place by screwbraces set 7 ft. back from each end. This replaces the ordinary wooden bracing and allows a free movement of dipper in the trench for three moves. When a section is finished, the beams are carried ahead by the dipper, the wooden braces are replaced on the top sheeting, and another set of 9-ft. sheeting is placed with two sets of braces for the lower portion of the trench, the lower end of sheeting being at a point where the invert curve meets the side wall.

The average progress on the plain concrete section per day of nine hours was 30 ft. for both shovel and mixer. This means 420 cu. yd. of excavation, with disposal in backfill or spoil bank. The actual costs of excavation, backfill and spoiling for plain and reinforced sections are given in Tables 1 and 2. The concrete averaged 2½ cu. yd. per linear foot—a daily average of 75 cu. yd. The average progress per day on the reinforced section was 24 ft.

A three-ring brick sewer in South Fifty-second Avenue, Cicero, extends from Ogden ditch to Twenty-second Street, a total length of 10,000 ft., of which 7,300 ft. were 7½ ft. and 2,700 ft. 7 ft. in diameter. With the exception of 1,050 ft. of the 7½-ft. section, which was in tunnel, the entire conduit was built on the line of an old 4 x 5-ft. wooden box sewer. The sewage flow was usually held back for periods of eight to sixteen hours, depending on rainfall, by a temporary gate, consisting of a 3 x 3 x 12-ft. inclosed box, having a sliding door working vertically about 4 ft. from the upstream end. The old wooden box sewer was first uncovered at a point 600 to 1,000 ft. ahead of the steam shovel. After the top was removed, the gate was lowered into the old box and packed in place with sand bags. The gate was operated by a lever at the ground level by a night watchman, who generally closed the gate at 6 a.m. and opened it at 7 or 8 p.m. A 45-ton Bucyrus steam shovel equipped with a 1¼-cu. yd. dipper, excavated the trench, placing the excavated material alongside. The average cut was 21 ft., made in a single cut. The existing box sewer was ripped out by the shovel as the trench advanced.

During the progress of the work, several severe rainstorms occurred, causing considerable delay and some damage. In a portion of the work where sheeting had been pulled, a severe rain caused the bank to slide, which, together with the added weight of the spoil bank, caused the collapse of 130 lin. ft. of completed sewer. The U. S. Weather Bureau record showed a precipitation of 1.57 in. for two hours. The cost of repairs for this 130 ft. was $11.46 per foot, or 94 per cent. of first cost. On account of storms and the softening of the bank by storms and ground water, shorter lengths collapsed. Because of the nearness to building foundations, thereafter sheeting and one set of braces were left in place at an additional cost of 90 cents per linear foot.

Utica cement was used, proving satisfactory in standing up under the night flow of water over new work. A small amount of pointing-up proved necessary in a number of cases where water was passed over the brickwork as soon as laid, and in a special case, when the breaking of the gate had flooded out the bricklayers before the invert could be laid complete. All material was teamed to the work, the average haul being ¾ mile.

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* From a paper presented at the Annual Meeting of the Illinois Society of Engineers and Surveyors. Abstracted by the Engineering Record.

† Assistant Engineer Sanitary District of Chicago.

The average progress per day on the 7-ft. section was 45 lin. ft., equivalent to 330 cu. yd. of excavation, while on the 7½-ft. section the average progress was 70 ft. per day with 20 ft. cut, or 500 cu. yd. of excavation. The difference in the progress between these two sections was partly due to the fact that the 7½-ft. sewer was built in a street 80 ft. wide, with open prairie on one side and unlimited room for work, and the 7-ft. section was built in a 66-ft. street with scant open space adjacent.

The average number of brick laid per day per bricklayer was 4,900 in the 7-ft. section and 5,900 in the 7½-ft. section. Backfilling was done with a Monighan revolving derrick, equipped with a Page 1-cu. yd. orange-peel bucket. This is a very efficient machine for backfilling, but the operator should avoid dropping the load from any distance, as it is liable to crack the masonry, especially during wet weather, when the backfill is saturated with water.

At the Illinois Central Railroad tracks excavation was made by hand and the spoil loaded into wheelbarrows and wheeled to the edge of the right-of-way, at which point it was handled by the orange-peel derrick. The piling and timbering of the tracks was done by the railroad company at its own expense. The hand excavation cost $1.25 per cubic yard.

In another case the steam shovel could not take out the bottom on account of the proximity of a viaduct. This earth was scaffolded out at a cost of $1.06 per cubic yard, being handled four times before it reached the spoil bank.

The moving of the steam shovel a distance of 1,050 ft. across a railroad yard and over the tunnel section cost $560, or 53 cents per linear foot. This includes the partial dismantling of the shovel to pass under obstructions. At the start the shovel was taken off the railroad spur, moved ½ mile and placed on timbers to span the trench, at a cost of $750.

Unit costs for the 7-ft. and 7½-ft. sections are given in Tables 3 and 4.

Tunnel Section

The tunnel section, 1,050 ft. long, extends under the Morton Park yard of the Chicago, Burlington & Quincy Railroad, and passes directly under five piers of the viaduct carrying South Fifty-second Avenue over the railroad yard. In places there was only 12 ft. of covering over the roof of the tunnel. The ground was stiff blue clay, containing but one sand pocket, which caused some earth settlement, visible at the ground surface. There were no settlements whatever at the piers.

The work was carried on by two night shifts of miners and muckers and a day shift of bricklayers, working eight hours each. One shaft was sunk, from which two headings were run. In one of the accompanying drawings is shown the method of timbering in good stiff clay. In poor ground the crutches were made longer, with the lower end set below the spring line, and the 2 x 10-in. planks at the roof were placed closer together. The excavated material was dumped

TABLE 1—COSTS FOR PLAIN CONCRETE 12 x 14-FT. SEWER; AVERAGE CUT 23 FT. 6 IN.

Cost per lin. ft.	Item	Cost per cu. yd.
$2.53 Labor	Excavation	Labor $0.188
.64 Plant		Plant .046
$3.17		$0.234
0.86	Backfill	0.143
0.89	Waste disposal	0.120
0.75	Miscellaneous	.....
1.21	Coal	.....
0.99	Lumber	.....
10.42	Concrete masonry:	
	Labor	1.316
	Cement	1.055
	Sand	0.576
	Gravel	1.103
	Plant	0.804
	Total	$4.133
$18.29	Material and plant 54%	
	Labor 46%	

TABLE 2—COSTS FOR REINFORCED-CONCRETE 12 x 14-FT. SEWER; AVERAGE CUT, 22 FT.

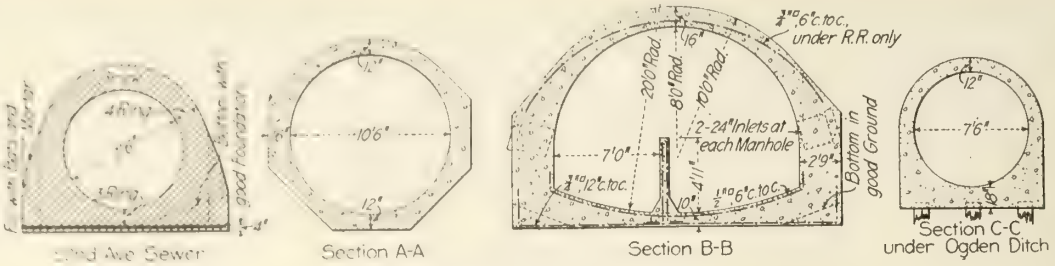
Cost per lin. ft.	Item	Cost per cu. yd.
$2.43 Labor	Excavation	Labor $0.194
.64 Plant		Plant .046
$3.07		$0.240
1.24 Labor	Back fill	Labor 0.249
Plant		Plant .021
		0.270
0.31	Waste disposal	0.041
2.26	Miscellaneous	.....
1.21	Coal	.....
0.99	Lumber	.....
14.85	Concrete masonry:	
	Labor	1.975
	Cement	1.055
	Sand	0.576
	Gravel	1.103
	Reinforcing steel	1.103
	Plant	0.084
	Total	$5.896
$23.93	Material and plant 52%	
	Labor 48%	

TABLE 3—COSTS FOR 7-FT. BRICK SEWER; AVERAGE CUT, 21 FT.

Cost per lin. ft.	Item	Cost per cu. yd.
$2.22 Labor	Excavation	Labor $0.308
.28 Plant		Plant .040
$2.50		$0.348
0.81 Labor	Back fill	Labor 0.226
.14 Plant		Plant .038
0.95		0.264
1.00	Waste disposal	0.544
0.19	Pumping	.....
0.62	Miscellaneous	.....
0.35	Coal	.....
1.12	Lumber	.....
7.60	Brick masonry:	
	Labor	2.63
	Teaming	.49
	Brick	4.08
	Cement	.57
	Sand	.29
	Total	$8.06
$14.33	Material and plant 49%	
	Labor 51%	

TABLE 4—COSTS FOR 7½-FT. BRICK SEWER; AVERAGE CUT, 20 FT.

Cost per lin. ft.	Item	Cost per cu. yd.
$1.63 Labor	Excavation	Labor $0.226
.28 Plant		Plant .040
$1.91		$0.266
0.43 Labor	Back fill	Labor 0.119
.14 Plant		Plant .038
0.57		0.157
0.41	Waste disposal	0.117
0.13	Pumping	
0.81	Miscellaneous	
[illegible]	Coal	
0.17	Lumber	
7.50	Brick masonry	
	Labor	2.10
	Teaming	0.30
	Brick	4.08
	Cement	0.57
	Sand	0.29
	Total	$7.34
$12.17	Material and plant 53%	
	Labor 47%	



Sections of brick and concrete sewers.

from the shaft into railroad cars and hauled 3 miles to Western Avenue.

The method of setting up the centres for the arch after the invert is built and timbering removed is shown in one of the drawings.

In each heading the average progress for twenty-four hours was 12½ ft. The average number of brick laid per eight hours per bricklayer was 3,000.

Table 5 gives unit costs for the work in the tunnel section.

Work on the South Fifty-second Avenue sewer outlet, in the Sanitary District section, is now under contract. The main section consists of a 12 x 16-ft. horseshoe-shaped sewer, the outfall being at the main channel of the Sanitary District at South Fifty-second Avenue. This section extends north 1,800 ft. from the canal to a point where it will divide into two sewers—10 ft. 6 ins. and 9 ft. The 10-ft. 6-in. section extends westward to Fifty-sixth Avenue, where it will connect with the 8-ft. 6-in. Oak Park sewer and the Berwyn 5-ft. sewer, both of which now discharge into Ogden ditch. The 9-ft. sewer will extend north across the Ogden ditch and connect with the 7-ft. 6-in. Cicero sewer. This section has a grade of 1 in 5,000, the grade being largely fixed by the elevations of the outlets of existing sewers. The dividing wall was designed to keep high velocities in dry weather and avoid deposits. At the upper end of the 16-ft. sewer stop planks are arranged, to divert the dry-weather flow to either side of the dividing wall.

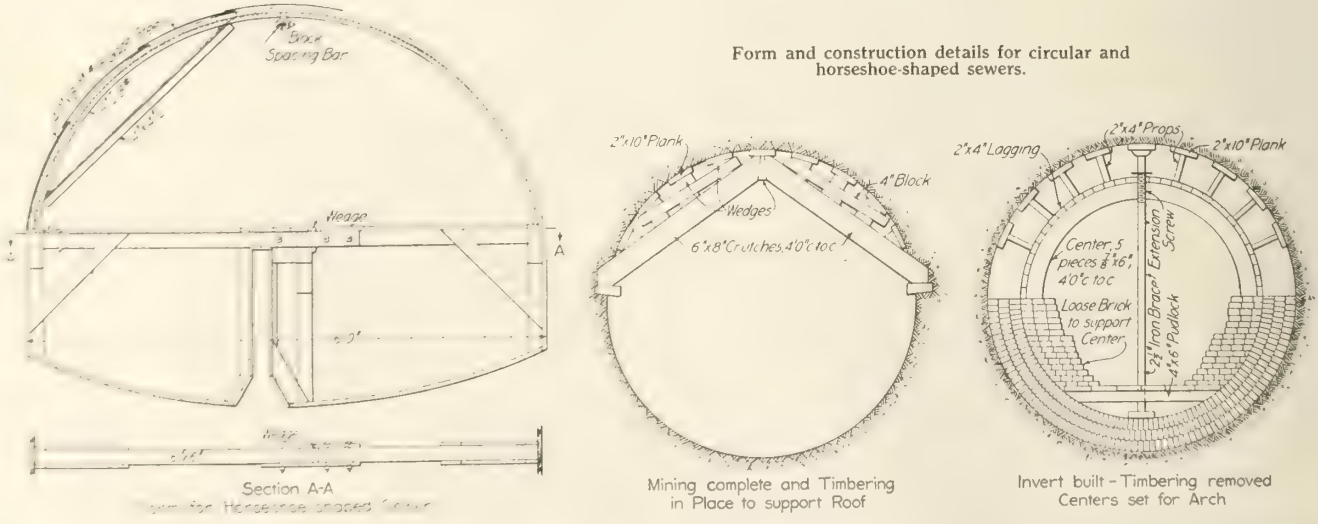
It was necessary to excavate through the spoil-bank of the Sanitary District main channel before the sewer trench could be started. The equipment comprises a 45-ton Bucyrus shovel with a 1¼-cu. yd. dipper mounted on 36-ft. timbers to span the trench. The average cut is now 17 ft., with a width of trench of 21 ft. 10 ins. Excavated material is loaded into 4 cu. yd. cars and deposited in backfill and the excess hauled about ¼ mile.

The entire work is to be built of 1:2½:5 concrete, except the dividing wall, where it is approximately 1:2:4. The order of pouring is as follows: invert, sides and arch. The invert and dividing wall in the 16-ft. section are reinforced with steel throughout, as is the arch for about 100 ft. where the sewer passes under the C. & I. W. Ry. The reinforcing is designed to take care of any unequal settlement due to soft ground.

Below the spring line the side forms are built of 1-in. flooring, nailed to 6 x 6-in. uprights, 4 ft. on centres, braced by a 6 x 6-in. cross timber at the spring line, supported by a 6 x 6-in. post near the centre of the sewer, with diagonals extending to the vertical posts. Above the spring line, 6-in. 8-lb. channels are used, curved to the proper radius, and reinforced with a 4 x 4-in. angle, 8 ft. long at the quarters. On the ribs, which are spaced 4 ft. on centres, is placed 2 x 6-in. lagging, on which sheets of No. 18-gage sheet steel is laid, lapping about 6 ins. For the dividing wall the form is built up of wooden sheets 8 ft. long, suitably braced against the side walls, with steel separators between to maintain the proper spacing.

Contract prices per linear foot for the work are about as follows: 16-ft. sections in 17-ft. cut, $40.63; 10½-ft. section in 12-ft. cut, $15.48; 9-ft. section in 14-ft. cut, $12.83.

For the use of the sanitary division of the district,


Brick Spacing Bar
Wedge
A
A
Section A-A
2"x10" Plank
4" Block
Wedges
6"x8" Crutches, 4'0" c. to c.
Mining complete and Timbering in Place to support Roof
2"x4" Props
2"x4" Lagging
2"x10" Plank
Center, 5 pieces ⅞"x6", 4'0" c. to c.
Loose Brick to support Center
2½" Iron Brace Extension Screw
4"x6" Pudlock
Invert built - Timbering removed Centers set for Arch

Form and construction details for circular and horseshoe-shaped sewers.

a daily report was devised, for labor and progress of the work, designed to fit either a brick or concrete job. The distribution of hours is made at the time the form is filled in. The rate per hour need not be filled in daily, since this can be covered on one sheet showing the rates for the entire job. From these reports a monthly tabulation is made, the rate per hour applied, and extensions made reducing the whole to a money basis. At the end of the job, the monthly statements are compiled, making one tabulation for the entire job. The weekly reports for material can be handled in the same way.

A daily report for material was also devised, showing the amount of cement in the warehouse, the amount used in the work, and the yardage of concrete placed. The tally on cement is kept by the inspector at the mixer as the bags are delivered. The inspector can also fill in the station numbers showing progress. The number of cubic yards placed can be entered by the engineer-in-charge. A small table showing the number of cubic yards per running foot of invert, sides and arch, is a very handy thing so that quantities can be entered without any extended computation.

The item of plant charge is a difficult one. For instance, there are steam shovels in service to-day that are twenty-five years old, whereas others are worth only scrap value at the end of three or four years. Many contractors charge off the entire plant to the job. So far as I see, for machinery such as steam shovels and dinkeys, it is fair to spread the plant cost over a period of ten years, allowing interest at 6 per cent. on first cost, thus making a depreciation charge of 16 per cent. per year. Alterations, fitting up, freight, small tools, etc., are directly chargeable against the job, and should be added.

TABLE 5—COSTS FOR 7½-FT. BRICK SEWER IN TUNNEL

Cost per lin. ft.	Item	Cost per cu. yd.
$6.49	Excavation	$2.43
2.05	Waste disposal	0.77
.40	Lumber	.....
.15	Power	
1.26	Miscellaneous	.....
9.35	Brick masonry:	
	Labor	4.40
	Brick	4.09
	Cement	0.57
	Sand	0.29
		$9.35
$19.70	Material and plant 27%	
	Labor 73%	

In considering the overhead charge to be made, some figure must be taken in making up an estimate. This is more apt to be too small than too large. In Illinois liability insurance will cost from 7½ to 11 per cent. of the payroll, and on work described in this paper the labor item is about 50 per cent. of the total field cost for open cut work, and 70 per cent. for tunnel work. This makes a charge of 3½ to 8 per cent. for insurance. Office rent, telephone, cost of getting work, and other items may increase this to 10 or 15 per cent. Adding 15 per cent. for profit, we thus have 25 to 30 per cent. to add to the field cost. With the aid of the data contained in the tables, reinforced by current market quotations on material, the author has made estimates for similar kind of sewer work, in the aggregate about one-half million dollars. Such estimates agreed with the low bid within 1½ to 2 per cent. In transferring the unit costs for work already performed to new estimates, due consideration must be made for differences in the local conditions, character of the soil, any increase in cost of labor, and the availability of standard types of machine to handle the work.

Municipal work at the city of Victoria, B.C., is by no means cast down. The City Engineer, Mr. C. H. Rust, advises us that the north-west sewer is now under construction at an estimated cost of $365,000. The work will be completed in 1915. Roadway and sidewalk work has been comparatively active this season and operations are expected to continue for another month. A large programme of paving work has been mapped out for next season, the total expenditure contemplated being between $400,000 and $500,000. The Sooke Lake scheme is progressing satisfactorily and it is hoped to have the pressure pipe line completed in January. The total length will be about twelve miles. The contractors for the concrete flow-line have laid eight miles out of twenty-seven. This work, it is expected, will be completed about next August. So far, the city has experienced no trouble in arranging for money, as most of the money was on hand for the work now under construction before the war started. Satisfactory arrangements have been made by the Council for the funds necessary to the completion of the Sooke Lake contract.

The bag house at Palmerton, Pa., for the New Jersey Zinc Company, has an 1,800-ton, 64½ x 805-ft. structural steel framework, 59 ft. high to the lower chords of the roof trusses. It is of regular simple construction, with tall spliced columns and light rivetted roof trusses, and has a large number of duplicate panels. The framework contains 162,440 pieces, handled separately in the field, none of them weighing more than 4,000 lb. The heaviest ones were assembled by a Bay City 25-ton long-boom locomotive crane which moved from end to end of the building on a longitudinal track, receding from the last finished bent. A considerable proportion of the lighter pieces were erected by hand without the use of the crane. The work involved driving 127,398 steel rivets and placing 70,793 permanent connection bolts and was executed by the Pittsburgh Construction Company.

Dynamite inserted in lengths of condemned fire hose was used to cut to pieces the steel drill barge Teredo, which had been sunk at Panama by an accidental explosion. It having been found impracticable to raise it, it was decided to cut it to pieces. The hose with its charge of explosives was placed along the line at which it was desired to direct the force of the blast and made a fairly clean cut. The sections sheared off were raised by wrecking barges assisted by a dipper dredge.

The American Society of Municipal Improvements will hold their Annual Convention at Boston, October 21-23. Mr. H. E. Mann, Chief Engineer, Montreal Light, Heat & Power Company, was elected President of the American Gas Association at the 7th Annual Convention of that body held recently in Ottawa.

From Ottawa comes news of the death by drowning of Jas. Wilson, a government engineer on the Hudson's Bay Railway. Mr. Wilson was a victim of a canoe accident in the Shell Rapids, in the Nelson river.

Speculations on the Problem of Housing the Working Classes in Vancouver

Contributed by R. McKay Fripp, F.S.A., Vancouver

THE object of all reform in housing is to provide fresh air within. This seemingly simple proposition is one of the most difficult problems which the larger modern city has to solve. In the first place, to have fresh air within, it is necessary to have fresh air without. This means ample open space, the most difficult and costly thing to secure when by bad town planning it has been lost. The first result of this loss is the slum, with all its attendant evils—overcrowding, discomfort, inconvenience, decreased health, physical and moral degeneration, increased criminal population, more police, more jails, more jailbirds. All these evils multiply like bacilli in a cess-pit and constantly spill over and spread contagion. Slums are indeed very poisonous and dangerous sores on the body politic. In old cities a slum is a regrettable incident difficult to remedy, for although the decayed district may be removed, the inhabitants of the warren cannot be eradicated; the rookery removed the rooks simply fly elsewhere.

But what is a regrettable incident in an old city becomes a disgrace in a new one. When those plague-spots appear in a new city of very moderate size, surrounded by a vast area of practically unoccupied country, it is obvious that they could have resulted only from very bad town planning, gross negligence or equally gross ignorance or apathy on the part of the civic authorities. But the important question now is not how the conditions arose but how they may be removed and their recurrence prevented.

This problem of Housing Reform is beginning to engage the attention of every progressive city north of the Mexican boundary. Not the housing of the rich or the moderately well-to-do. This part of the problem generally finds its own solution; for except in the somewhat unique instance of Vancouver, new developments in medium-class residential districts are planned so as to ensure ample space for air and sunshine, for the disposal of residential buildings with due regard to aspect and prospect, for the creation of lawns, gardens, shrubbery and trees. In brief, it is rapidly becoming the custom to plan and design where heretofore the sole object has been to make the greatest possible number of the smallest possible lots absolutely without regard to the other considerations.

Public health is a purchasable commodity. It can be bought, and the price that is paid for it includes fresh air, sunshine, parks, recreation-grounds, playing-spaces for the children, gardens, trees, grass, flowers—all for the public—and fresh air, sunshine and cleanliness within the home.

The chief cause of tuberculosis is, as every one knows, the absence of, or insufficiency of, two of the cheapest things on earth—fresh air and sunshine. The remedy is an ample supply of fresh air and sunshine, and the preventive measure is the continued assurance of that ample supply of Nature's cheapest provision, by the provision of open spaces, not only in the form of parks and playgrounds, but by the disposition of the mass of poorer homes in such manner as to ensure free action of air and secure the maximum of sunshine. Not only does it pay a city, from the hygienic viewpoint, to provide ample public open spaces, but it is the greatest influence for good in other ways, for it has been demonstrated over and over again that of the children and younger criminals who fill our reformatories, 80 per cent. are recruits from the gutter and the overcrowded districts. All public parks or open spaces are fine investments from the real estate point of view. They increase in value; other public works depreciate. They not only pay for themselves, they also create new real estate values in their vicinity. They are therefore money-makers as well as money-savers; they make for good citizens instead of human derelicts and good human assets as opposed to human wastage—the worst and most deplorable form of wastage. This is all so well known, so frankly acknowledged, that it is the more extraordinary that civic bodies do not render overcrowding absolutely impossible. As a matter of fact the civic authority invariably is the great stumbling-block, the bar most difficult to remove from the road to progress. The perennial excuse is either the absence of enabling powers in the city charter, or the want of funds. Either is so invalid that when used it may be concluded that the proposed reform or development is opposed. The obsolete system of representation by wards is frequently responsible for this opposition.

Vancouver's Growing Population

The population of Vancouver is well over 100,000 —not a very large figure, but there is no doubt that after the war and the return of normal conditions there will be a steady, and possibly a rapid, increase. With this increase will inevitably arise the problem of housing near their points of employment an ever-growing body of workers. At the present time there is no attempt to deal with the question: the working classes shift for themselves. Quite a fair proportion have or are proceeding to acquire their own houses. Without any figures to guide me I am led to believe from observations of my own that the great majority of those owning their own homes are artisans, carpenters, stone masons, bricklayers and so forth, earners of high wages, ranging from $3.50 to as much as $6.00 a day. Very few indeed of these live within easy walking distance of their work, most of them being driven by the high price of land to seek lots more within their financial scope in comparatively outlying districts; but the proportion of the working population in any large and growing city which can or do become "owners" is always small and does not materially affect the question of providing suitable, i.e., healthy, convenient, cheap housing for thousands of wage-earners. It must be borne in mind that the item of rent goes far to determine the scale of living.

The wage-earners are, broadly speaking, divisible into four classes—those whose earning capacity is below the normal, unskilled labor of the minimum standard rent-paying capacity; more highly paid unskilled labor, and highly paid skilled labor. It is members of the first class that sink most easily to the level of the slum dweller and this class affords the most serious economic proposition, for it is unable to pay a rent based even upon the lowest standard of decent housing. It is a class ever present in every city and evinces always a strong tendency to increase. The average earning capacity is difficult to arrive at, but assuming the maximum at $10 a week as being probably sufficiently near the mark, what description of accommodation can be provided at the highest rent that can be squeezed from such earnings?

It is necessary to fix some standard of housing before fixing standard rents, and to do this a great deal of preliminary calculation has to be made, and other standards not exactly "fixed" (which is good only in the case of irreducible minimums), but approximated and made adjustable to local conditions.

The tenement-house is but a slightly mitigated evil and is regarded as such by all modern students of housing reform. It is impossible, in a short article, to deal in detail with the reasons that have lead to this conclusion: all I can do is to state the main facts. The 4, 3, 2 and 1-family homes are admittedly the best forms of housing. In 4 and 3-family homes the building may assume externally the appearance of a single house. In no case, even when the one-family home is built in rows, need the result be wholly monotonous, unattractive or wanting in individuality, but this is exceeding my limits. The lowest standard of efficient home consists of a living room, kitchen, a small scullery for washing, fuel, etc., and one bedroom for two adults and one infant, a toilet and bath, additional bedrooms for each additional two, or at most three, children. The sizes of the rooms vary slightly, averaging 150 square feet for living room-kitchen, 80 square feet for scullery, 140 square feet for each bedroom or a total area of 550 square feet when walls, bathroom and chimney are allowed for.

The most economical, decent method of arranging these "lowest standard" homes within fire limits is that adopted by the London County Council. A certain area of land is purchased and surrounded by the buildings in such a manner as to leave an interior court of considerable dimensions—large enough to provide a community playground with seats, trees, grass and space for drying the wash. These grounds are not for the children only: they serve for the women also, and as social meeting places for the men and women after work. The rents are as low as 60c. a week, or about one-eighth of the weekly wages. Small as this return is, it is said to be an economical rent—that is, the return upon the whole investment covers the interest and charges. It would seem that here we have a satisfactory solution of this section of the housing problem, especially when the municipalities in England pay nearly as high an interest on the money borrowed as our own municipal borrowers; indeed, it is probable that the rate of interest is higher when the rate of wages is taken into consideration. This being so, why should there be the slightest danger of slum areas arising in Vancouver? Yet the danger does exist where there is over-crowding with all its attendant evils. Apparently, then, it is obvious that all the civic authorities need do is proceed to condemn and purchase a few blocks conveniently situated and erect a sufficient number of the type of dwelling proved to be most necessary, raising the funds by a 4 per cent. or 4½ per cent. loan. But when one reduces the proposition to dollars and cents the figures are disconcerting. The average "block" contains 20 lots, 25 ft. x 120 ft., a 20-ft. lane and a parallel row of twenty lots, which gives a total area of 500 ft. x 260 ft., the obsolete "lane" or "alley" being closed. Upon this, in the form of a hollow oblong, seventy-two lower standard homes can be erected, each containing 11 ft. x 13 ft. 6 in. living room-kitchen, small pantry, 8 ft. x 9 ft. scullery with sink, washtub and bath, and a 3 ft. x 8 ft. fuel and tool shed, and three bedrooms in the upper half-storey, respectively 12 ft. 6 in. x 8 ft., 11 ft. x 8 ft. 4 in. and 7 ft. x 8 ft. 3 in. These sizes are of course variable. Each house has its own front door and small porch, a few feet of front garden, say 8 ft. 6 in., plus over-all depth of house, 20 ft. 6 in., and 36 ft. for back yard, giving a total of 65 ft. Double this for the parallel row, 130 ft., leaving 130 ft. x 370 ft. for the community playgrounds, not including a garden entrance at each end 51 ft. x 65 ft. The actual open space from back wall to back wall would be 192 ft. width by 442 ft. in length—surely a most desirable arrangement.

The Question of Cost

Now as to cost. Forty lots in all, four of which are corners and valued at probably 50 per cent. more than inside lots, are estimated to cost $45,000, and this is considered a minimum. The houses, if erected with concrete exterior and dividing walls, and rough cast on the outside, roofed with slates, would probably cost $1,000 each if erected all at once. The cube taken is 20 ft. 6 in. x 16 ft. 6 in. floor area. Allow 2 ft. for floors and foundation, 8 ft. height of lower storey and 8 ft. 6 in. to upper surface of ceiling joists in half-storey—that is 20 ft. 6 in. x 16 ft. 6 in. x 18 ft. 6 in., equal to 6,257 cubic feet, which priced at 16c. is $1,001. The pro rata ground value is 1-72 of $45,000, or $625. The cost of each house and land then is $1,626, to which must be added not less than $124 for clearing, preparing the gardens, sewer and water connections, fees and incidental costs—$1,750, a grand total for seventy-two houses of $126,000. This sum borrowed at 4½ per cent. involves for annual interest alone a sum of $5,670, to which must be added cost of repairs, loss by vacant houses, cost of collecting rents, and insurance. The first two items can only be estimated.

These houses being built for the specific purpose of relieving or preventing congestion, and for occupation by the class least capable of paying a normal rental, they must be considered only from this point of view. What rent can be paid by this class? The usual proportion of rent to wages is from one-tenth to not exceeding one-eighth. The probable maximum average earning capacity of this class is stated variously at from $8 to $12, or a rent-paying maximum of $1 to $1.50 per week, an average of $65 per annum, leaving a deficit of $13.75 interest on the first cost of each house and land, or $990 on the block. Add to this amount the loss of rent by vacancy, inability to pay rent from various causes, insurance, repairs, collections, and sinking fund, and this deficit rolls up to formidable proportions.

The estimated cost of the building cannot be reduced; it might even be enhanced. The estimated cost of land within easy walking distance of the points where the sub-normal earning class finds employment cannot be reduced, and cheaper land can only be secured at points so far removed from the place of employment that car-fare amounting to a disproportionate increase of rent would have to be paid by a class of tenants frequently more or less in arrears. To raise the rental is to defeat the object. It appears, then, that the housing of the sub-normal wage-earner can only be met in a satisfactory manner at a loss. But when all the advantages of meeting the problem by housing at a certain cost to the city are considered and added to the credit side, there is an immense gain to the community.

Let us suppose that in Vancouver there are 2,500 sub-normal wage earners, including their children and

and dependents, allowing an average of six persons to each of the houses described, 132 soul's would be accommodated in decency and comfort and amidst surroundings calculated to great sociological improvement. Six such blocks would house the 2,500. Estimating the annual loss in each block at $2,000, this will represent the cost at which the slum is prevented and the standard of living, health and morality raised to normal. As the young grow up under favorable conditions there is an ever-decreasing tendency to the jail and the reformatory. Even if the price is underestimated, is it—can it be, too high?

The second class of wage-earners should be housed without loss in the same manner, to the huge benefit of the class. The third class of earners being usually in steady employment should be provided for with due consideration to their needs, such as the addition of a good living-room, as distinct from the kitchen and rather larger bedrooms. There are endless models to guide and instruct, and possibly a basement may be added. The fourth class, skilled wage-earners, should also be treated in a generous spirit. There should be no effort made by the city to make a profit out of them. The rents should be sufficient to cover all expenses and provide a sinking fund and no more, and if the housing is planned and carried out on a sound business basis, the rent will be low enough to appeal to the section of the public it is intended to attract.

A volume might be written on Environment and Efficiency. An ill-planned city provides an environment that may be positively injurious and render complete efficiency impossible, interfering with the relationship of Transit and Housing. In spite of all the talk about City Planning, and the fact that existing defects are due to the absence of skilful planning, these same defects are constantly repeated, extended and perpetuated. Civic bodies having discovered that the remedy of old blunders is expensive, seem to think (if they do think—which I do not venture to assert) that it might also be expensive to avoid the repetition of blunder. The silly rectangular plan has become a habit.

Canadian Pacific Deck Plate Girder Spans

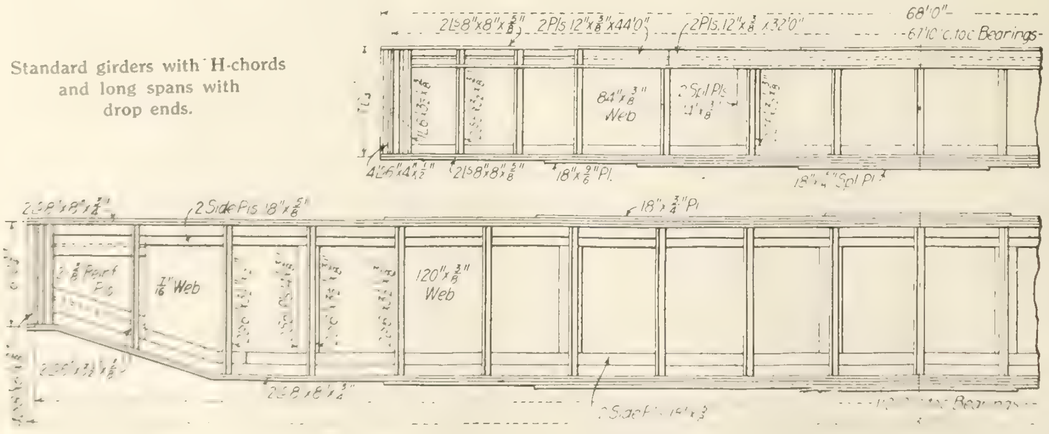
Loads, Stresses and Dimensions of Typical Single-Track Viaduct Deck Spans Measuring in Length 114 and 70 Feet

At the end of the fiscal year, ending June 30, 1913, there were in existence on the Canadian Pacific Railway 4,267 bridges and open culverts. These had an aggregate length of 440,237 ft. (85.7 miles). There were 29,704 culverts other than open, of which 16,866 were permanent and 12,838 temporary. During the year 397 old bridges and open culverts were replaced, aggregating 37,063.5 lin. ft.; 1,070 culverts, other than open, and overhead bridges were replaced; 195 new bridges aggregating 25,388.3 lin. ft. were added during the year. The number of temporary bridges has been reduced during the year by 165, aggregating 10,088 lin. ft. (1.9 miles), and new turn-tables have been fabricated, ten 70 ft., one 80 ft., and one 100 ft. in diameter. The accompanying plans show typical features of long single-track deck plate girder spans used in the bridges.

Span of 114 Feet

Bridge 880 over the Trent River is a plate-girder viaduct 1,493 ft. long and about 50 ft. high from low water to base of rail. It contains one span of 114 ft. over the deepest part of the channel and the remainder of the structure is chiefly composed of 30 and 45-ft. towers and tower spans connected by 75-ft. spans except in a few cases of spans of from 45 to 69 ft.

The design, conforming to the standard railway specifications for 1908, provides for two 177.5-ton locomotives equal to Cooper's E50. For the span of 113 ft. 10 in. (nominally 114 ft.) this live load produces a total moment of 10,865,800 ft.-lb., requiring a flange area of 70.5 sq. in. The maximum shear of 428,500 lb. is resisted by an 84 x 7/16-in. reinforced web plate at the end and by a 120 x ⅜-in. web plate in the center. The maximum flange area of 71.9 sq. in. net is made up of two 8 x 8 x ¾-in. angles, two 18 x ⅝-in. side plates, and three 18 x ¾-in. cover plates. The top and bottom flanges are the same except that the latter were bent to conform to the reduced depth at the end of the girders corresponding with the depth of the girders in the shorter span. The top and bottom lateral systems are the usual X-brac-



Standard girders with H-chords and long spans with drop ends.

ing of single 6 x 4-in. angles, with connection plates engaging the horizontal legs of the flange angles. The intermediate sway frames are all X-braces of 4 x 4-in. angles.

The 70-ft. girders, actually 69 ft. 10 in. long, have moments of 4,259,300 ft.-lb., requiring a flange area of 41.6 sq. in., and a shear of 279,000 lb., provided for throughout by an 84 x ⅜-in. web, with two shop-riveted splices. The top flange differs from the bottom flange in that it has an H-shape cross-section with a gross area of 51.4 sq. in., and is made up of four angles with their vertical legs reinforced, while the lower flange has a T-shape cross-section with a net area of 42.47 sq. in., made up of a pair of angles having their horizontal instead of their vertical legs reinforced. The lateral systems are the same as in that the upper transverse strut has an I-shape section made with top and bottom flange angles latticed instead of plain angles.

The bridges were designed by the engineering department of the Canadian Pacific Railway, of which P. B. Motley is bridge engineer. The viaduct, weighing 785 tons, including 105.2 tons for the 114-ft. span and 40.6 tons for the 69-ft. span, was fabricated and erected by the Hamilton Bridge Works Company, of Hamilton, Ont.

The authorities in charge of the construction of buildings at Delhi, the new capital of India, are investigating a plan of providing outer and inner walls, between which artificially cooled air can be circulated by means of exhaust fans, the cooling being effected by drawing currents of air through wetted screens.

Plans are being prepared and tenders will be called shortly for another unit of the five-million dollar ship building plant which is being erected at North Vancouver, B.C., by the Dominion Shipbuilding and Dry Dock Company, Limited. The new work will comprise machine shops, two marine railway buildings and two concrete wharfs.

Forged iron and steel produced by rolling mills and steel works in Canada during 1913 aggregated about 23,405 tons, of which about 2,578 tons were iron and about 20,827 tons were steel. During 1912 the production was 22,415 tons, of which about 867 tons were iron and about 21,548 tons were steel, according to a special bulletin of the Bureau of Statistics of the American Iron and Steel Institute.

All would have been well, observes the Monetary Times, had Kaiser Wilhelm got J. F. Spence, of the Canadian Guardian Life, to insure his army; H. F. Malcolm, of the Western Canneries to feed them; J. W. Moyes, of railway fame, to electrify them; H. Pollman Evans, of the Union Life, to draft their policy; Mayor Martin, of Montreal, to finance them; Billy Macelan to run their banks; and Controller Church, of Toronto, to give them the "glad hand."

Advance production charts, which are in fact estimated progress curves plotted in advance of the work done, have been used by the Aberthaw Construction Company,, of Boston. Their use, it is said, has made it possible to spread the whole work out more evenly, thereby keeping the force fairly constant for long periods, making the workman feel that his job is reasonably secure during the continuance of the construction work, and eliminating the disorder that results from the sudden influx of untrained men when part of the work must be rushed.

Water supply is an expensive item in starting a station in Queensland. Tank sinking costs about $4,000 for a 10,000 cubic yard excavation, and nothing less than this has much hope of holding out for long against the loss through evaporation. Many of the tanks are nearer 30,000 cubic yards. The alternative to a surface tank is an artesian bore, which involves risk and great expenditure. It is necessary to go down to anything between 1,000 ft. and 4,000 ft.; in fact, the deepest bore in Queensland is over 5,000 ft. Roughly speaking, boring works out at about $5 per foot.

Personal Mention

Mr. A. W. Post, Works Commissioner, and Mr. Robert Martin, Mayor, of Regina, were visitors to Toronto last week.

Mr. J. C. Ross has succeeded Mr. Henry Dodue as Chief Engineer of the Yarmouth Light & Power Company, Yarmouth, N.S.

Dr. Nasmith, of Toronto, left Valcartier with the First Contingent as Advisory Officer on Sanitation to the Canadian Expeditionary Force.

Mr. W. H. Ellis is Acting Dean of Engineering at the University of Toronto, filling the vacancy occasioned by the death of Dr. Galbraith.

Mr. Peter Lyall, President of the Lyall Construction Company, has been successfully operated upon at the General Hospital at Montreal.

Mr. Geo. P. Hugnot, formerly a member of the architectural staff of the Public Works Department at Ottawa, was wounded at the battle of the Aisne.

Mr. R. D. S. Beckstedt has been appointed Superintendent of the Tagona Water and Light Company, Sault Ste. Marie, succeeding Mr. R. A. Campbell.

Major E. C. Norsworthy, of Montreal, prior to his departure for the front with the Royal Scots, was elected a Director of the Canada Cement Company.

Mr. J. Chapman, of the American Well Works, Aurora, Ill., has been paying a visit to Medicine Hat and other Western towns with a view to locating a branch factory.

Mr. H. W. Scott, Manager of the Montreal Office of the Jeffrey Manufacturing Company, has resigned to establish himself in the engineering and contracting business.

Dr. L. A. Herdt, of McGill University, and Chairman of the Montreal Electrical Commission, has left for Europe on private business. He will be away for several weeks.

Mr. Harry Edward Prindle, formerly Canadian representative of Messrs. [illegible] has opened an office at 915 New Birks Building, Montreal, for the general practice of architecture.

Mr. R. C. Misson, Sales Manager, Eastern Division, Sherwin-Williams Company of Canada, Limited, has been appointed to the position of Manager of the Eastern Division, with headquarters at Montreal.

Mr. A. H. Ayers, formerly Division Engineer on the irrigation project of the South Alberta Land Company at Alberta, has been appointed Engineer of the [illegible] of the United States Reclamation Service at Fort Shaw, Mont.

Mr. [illegible] Warner has been appointed eastern sales representative of the Dominion Paint Works, Limited, Walkerville. His headquarters will be at Toronto, but he will have control of the business of all the eastern provinces, with Montreal office at 411 Transportation Building.

Mr. Thos. Mawson, the well-known English town planning expert, has been engaged by the Conservation Commission at Ottawa to act in an advisory capacity in the work of encouraging more attention to town planning in Canada. His services have been obtained by an arrangement with the Local Government Board, of London.

Mr. H. Reginald Davison, Industrial Commissioner of Vancouver, is visiting Cincinnati, Ohio, Toronto, Montreal and Winnipeg. The journey is made necessary to conclude arrangements which are expected to lead to the establishment of new industries in Vancouver as the culmination of an extended correspondence with manufacturers in the cities mentioned.

Captain Ritchie is in command of an engineering corps raised at Toronto by the Canadian General Electric Company, for service at Quebec, Halifax, and Esquimalt. The corps is at the disposal of the government and it will be maintained by the Company until the war is over. The members of the corps are: H. S. Elliott, Charles Stewart, C. Pink, W. J. Swanger, F. G. Jackson, H. Williams, E. S. Shill, A. T. McLean, W. S. Johnson, J. S. Dunlop, G. Hillier, C. Henry, George Monaghan, A. Hardie, J. C. Munro, C. C. Rous, P. Foster, E. Crockford, H. S. McKean, A. J. Palmer, R. W. Nurse, H. Calvin, R. Bethune, H. Bestard.

Corps of Engineers organized by the Canadian General Electric Company for service in Canada. The men are distributed between Esquimalt, Quebec and Halifax.

Mr. George W. Coburn has been appointed district engineer for the Canadian Pacific Railway, with headquarters at Brandon, Man. Mr. Coburn started work for the Canadian Pacific in 1896 as rodman and draftsman at Farnham, Que. From 1900 to 1902 he was engaged on construction work on various parts of the system, and in 1902 became assistant district engineer and draftsman at Souris, Man., later at Brandon, Man., and then at Moose Jaw, Sask. Since 1907 he has been district engineer at Souris. Mr. Coburn is an Associate Member of the Canadian Society of Civil Engineers.

Mr. Charles A. Ellis, formerly Resident Engineer, Dominion Bridge Company, Winnipeg, has been appointed Assistant Professor of Civil Engineering at the University of Illinois. Prof. Ellis graduated from Wesleyan University, Middletown, Conn., in 1900. For a year he was Assistant City Engineer of Middletown, and for seven years Structural Engineer with the American Bridge Company at Berlin, Conn., New York City and Ambridge, Penn. He was Assistant Professor of Structural Engineering at the University of Michigan from 1907 to 1912, and since then has been with the Dominion Bridge Company.

Mr. H. C. Grant, formerly Superintendent of the Canadian Pacific Railway at Brownville Jc., Maine, and recently Assistant General Superintendent of the Atlantic division at St. John, N.B., has been promoted to be General Superintendent of the Atlantic division, succeeding Mr. William Downie, who has retired after a service with the Canadian Pacific Railway extending over 27 years. Mr. Grant is a graduate of the engineering staff of the railway. He was in the Construction and Maintenance-of-Way departments from 1898 to 1910, rising from the position of Rodman to that of Assistant Division Engineer at Toronto. Since 1910 he has been in the operating department.

Mr. W. P. Wilger has been made Professor of Civil Engineering at the School of Mining, Queen's University, Kingston, Ont. Prof. Wilger, in 1901, began engineering work as transitman on the Kingston & Pembroke Railway. In 1902 he was made locating engineer for the Bay of Quinte Railway, and later was resident engineer for that railway. In 1904 he became locating engineer on the Central Ontario Railway, and later in that year was placed in charge of a party on exploration for the Transcontinental Railway. For four years following he was locating engineer for the Transcontinental and from 1908 to 1911 was division engineer. Since 1911 he has been assistant district engineer.

Messrs. Kelly & Sons, contractors and brick manufacturers, Winnipeg, who were recently awarded a large contract on the Winnipeg aqueduct, have been in business under that name in Winnipeg since 1908, when Mr. Thomas Kelly, a contractor of 35 years' experience in that city, associated with him his three sons, Robert Emmet, Charles Bernard and Lawrence Corbett Kelly. The firm is at present engaged on the new Parliament buildings at Winnipeg, a contract amounting to over $2,800,000. Mr. Thomas Kelly, the founder and president, was born in Ireland in 1855, and went to the United States at the age of nine. He was educated in Oneida County, New York, and entered business in Winnipeg 35 years ago. He was founder and head of the firm of Kelly Bros., contractors, which firm became Kelly Bros. & Company, and later was merged into The Manitoba Construction Company, Limited, of which Mr. Kelly was president and manager from 1903 to 1905. He was then president and manager of Kelly Bros. & Mitchell, Limited, until 1908, when he established the present firm. Mr. Kelly is also president of the Manitoba Quarries, Limited, and the Master Builders' Liability Insurance Company. During his long career he has been the builder of many of the larger public and office buildings in the city and of the Canadian Pacific Railway shops, the Canadian Northern Railway shops, and substructures of several of the bridges across the Red and Assiniboine rivers at that place. The firm's contract on the great aqueduct includes the Brokenhead section, and will involve 300,000 cubic yards of earth and 6,000 cubic yards of rock excavation, 429,000 cubic yards of refill and embankment, 113,000 cubic yards of foundation, 75,000 cubic yards of concrete, and 1,460,000 lbs. of reinforcing steel. The contract price is $1,301,485.

Colin Maxwell, Contractor

Mr. Colin Maxwell, of Transcona, Man., whose photograph is reproduced herewith, is now engaged in general contracting practice in Western Canada. He is a native of Portage la Prairie, and in his early days spent some time with his father practising architecture. Later he became identified with such important constructional enterprises as the erection of the C. P. R. Station and Royal Alexandra Hotel at Winnipeg. In 1905 he went to Montreal in the service of Messrs. C. E. Deakin & Company, after which he was in full charge of the construction of a $1,500,000 reduction plant, and the installation of the machinery, for the Nickels Chemical Company, Tweed, Ont. For three years following he remained in the east, devoting his activities to various important enterprises. In 1909 he went to Winnipeg to tender for the G. T. P. shops at Transcona for Messrs. Haney, Quinlan & Robertson. He returned east with a tender which was accepted and was appointed to take charge of the work, which was completed last spring at a cost of some $5,000,000. Mr. Maxwell sticks to contracting pretty closely, but not to the sacrifice of other interests. He was the first Mayor of Transcona in 1911 and has served the municipality as School Trustee. He is a Freemason and a Forester, and he [illegible]

Mr. Colin Maxwell

Mr. T. J. Kennedy, of the Superior Construction Company, Limited (Franz, Ont.), has gone to Sault Ste. Marie to assume control of the [illegible] of the Lake Superior Corporation. The Superior Construction Company, Limited, are the contractors for the Algoma Eastern Railway, from [illegible] Hill to [illegible] miles, and for the Algoma Central and Hudson Bay Railway, from Hobon to the National Transcontinental, 101 miles.

A federal charter has been granted to the Imperial Pipe Line Company, Sarnia, Ont., capitalized at $1,000,000

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

The Montreal office of Messrs. Palmer, Hornbostel & Jones, architects, was discontinued on October 1st.

At the recent convention of the Trade and Labor Congress at St. John, N.B., it was decided to hold the next meeting in 1915 at Vancouver.

Mr. A. F. Macallum, City Engineer of Hamilton, will report to the City Council on the road work that can be put in hand during the fall and coming winter.

The new post-office at Collingwood, Ont., built at a cost of $108,000, is practically finished. The contractors are Messrs. Healy, Herrington & Bryan, Collingwood.

The Algoma Steel Corporation, Sault Ste. Marie, Ont., are busily engaged in the manufacture of certain parts of 200,000 shells which are being turned out in Canada for the artillery.

The building permit for the new Customs House now being erected on Sussex street, Ottawa, places the estimate of cost at $1,173,000. The foundation work was exceedingly difficult and cost over $500,000.

Mr. Geo. Janin, Chief Municipal Engineer, at Montreal, has been instructed by the Board of Control to report upon works which should be completed this season. The sum of $1,500,000 is available for such undertakings.

Mr. J. F. Whitson, who is in charge of the Northern development work for the Ontario Government, reports that $2,500,000 has been expended in road work and that between 800 and 900 miles of roadway have been improved.

The representative of an English syndicate was at St. John, N.B., recently, enquiring into housing conditions. It is said that he was negotiating for a site in the eastern end of the city for the erection of one hundred or more workmen's dwellings.

At Fort William it is reported that the Superior Brick Company's plant will in all probability be kept in operation continuously until the spring. The Company have just been awarded the contract to supply upwards of 1,000,000 bricks for use in the construction of G. T. P. roundhouses.

Tenders for the foundation work in connection with the new hospital building which is to be erected at Hamilton, Ont., at a cost of $200,000 will be called shortly and the remaining bids will be received in the spring. The architects are Messrs. Stewart & Witton, 2 Hughson Street S., Hamilton.

Good progress is being made on the school building which is being erected on Charlotte Street, London, Ont., by the Board of Education. The school is two storeys high, of brick construction, and will cost $100,000. The architects are Messrs. Watt & Blackwell, and the general contractors Messrs. J. Moran & Son, both London firms.

At Toronto, tenders for an office building, estimated to cost $300,000, for the Provincial Hydro-Electric Commission, are being received until [illegible] The building, which has been designed by the Company's engineers, is to be of steel and [illegible] construction. The Secretary of the Commission is Mr. W. W. Pope, Continental Life Building, Toronto.

Welland, Ont.—It [illegible] that [illegible] the Electric Steel & Metals Company, Limited, will begin operations at once with [illegible] hundred men. The Company have received from the British War Office a contract for shrapnel shells which will keep one hundred and sixty men employed continuously until next April.

According to a report from St. John, the western section of the spandrel arch bridge across the St. John River is now completed and the eastern section is well advanced. The steel work, which is under contract by the Dominion Bridge Company, will be completed before winter sets in. The bridge, which spans the Reversing Falls, will be ready for use in the spring.

An Owen Sound reader predicts a great revival in the iron trade. Writing to the Contract Record he says that the country will soon be off to the greatest race in Made-in-Canada goods it ever knew, and that incidentally the iron and steel works of Owen Sound will reap the benefit. Already the factories are working in full force to keep up with the orders for transport and artillery vehicles. The foundries are equally busy turning out shells for artillery ammunition. As a side issue, the boom makes things lively for tent-makers, canvas-workers, knitting factories, clothing manufacturers and leather workers.

WESTERN CANADA

The British Columbia Sheet Metal Works, Limited, Vancouver, B.C., has been incorporated with a capital of $10,000.

The new building erected at Edmonton for the Bank of British North America has been completed at a cost of some $160,000.

The Sidney Island Brick & Tile Company, Limited, Victoria, capitalized at $150,000, is a new British Columbia concern to receive a charter.

A bridge estimated to cost $750,000 is under contemplation at Victoria, B.C., and the ratepayers will be asked this year to vote on a by-law to raise the required amount.

At Saskatoon, the total fire losses during the month of August amounted to rather more than $3,000,000. The fire insurance rates at Saskatoon are the lowest in Saskatchewan.

The new plant of the Maple Leaf Milling Company, at Medicine Hat, is practically completed. The contractors for the building are Messrs. Geo. H. Archibald Company, Winnipeg.

At Vancouver, operations are about to be commenced on the Balaclava sewerage project. The cost of the work is estimated at $150,000. Tenders for the material will be called shortly.

At Prince Rupert, B.C., the G. T. P. have decided to build a large dry dock capable of accommodating a 20,000-ton battleship. Constructional operations giving employment to several thousand will be started on January 1.

Construction work is to be commenced this fall on the factory and office building in Manchester, a suburb of Calgary, for the Western Canada Cordage Company, Limited. The building will be 400 ft. by 120 ft. in dimensions and will cost approximately $150,000.

At Regina, public works to the value of approximately $350,000 will be proceeded with at once. The undertakings scheduled for completion include a 5,000,000-gallon reservoir, filter beds at the sewage disposal works, the Isolation Hospital and the proposed water and sewer extensions.

The new building which the Winnipeg Public School Board is erecting at the corner of Manitoba and Power Streets, at a cost of $150,000, is advancing rapidly towards completion. The building has three storeys and basement, and is of brick, stone and reinforced concrete construction

The steel work on the new Winnipeg warehouse now being erected by the Coca Cola Company, of Atlanta, Ga., at a cost of $550,000 is completed. The architect is Mr. Arthur Tufts, Baltimore, Md., and the general contractors are Messrs. Jos. McDiarmid Company, Canada Building, Winnipeg.

The large bridge with which the C. P. R. is spanning the Saskatchewan River east of Empress, Alta., is nearing completion. It is hoped to have the new line from Swift Current to Bassano completed by October 15. The contractors for the steel work of the new bridge are the Canada Bridge Company.

A new school building at Prince Albert, Sask., erected by the Separate School Board at a cost of $100,000, is nearing completion. The building is two storeys high, of concrete block and red brick construction. The architect is Mr. A. Graham Creighton, and the general contractors are Messrs. Bonas Bros.

The Provincial Highway Board of Saskatchewan is cooperating with the various municipalities throughout the province with a view to increasing the expenditure on road and bridge work. Already arrangements have been made for the expenditure of some $500,000, and some two hundred road gangs are in operation. The Chairman of the Board is Mr. F. J. Robinson, Regina.

From Edmonton comes the report that a Company to be known as the Conotolite Marble Company, is to be formed for the manufacture of a new invention called Conotolite marble. The new building material is said to have disclosed remarkable properties in regard to tension strength and crushing power. Those interested in the project are Messrs. D. Kennedy, R. W. McKennel, H. E. McLuhan, P. R. Schick, W. F. Brown and W. F. Cavanagh, of Edmonton.

The Hare Engineering Company, Limited, Toronto, manufacturers of power plant equipment and special machinery, have removed from 78 Duchess Street to more commodious quarters at 115 King Street East.

Good roads men are reminded of the Fourth American Road Congress, which is to be held at Atlanta, Ga., November 9-14. Special trains for the meeting leave New York City on November 7. Western delegates will be accommodated by a special train from Chicago. It is stated that forty-seven National and State Associations will take part in the meeting. Detailed particulars may be obtained on application to the Secretary of the Congress, Mr. I. S. Pennybacker Colorado Building, Washington.

An interesting new standard overhead crane has been introduced to the Canadian market by the Herbert Morris Crane & Hoist Company, Limited, A description of this crane is embodied in bulletin B9, of which a copy has just reached us. Instead of running on the top of a rail, as is usual in overhead traveling cranes, the type "S6" is designed to run on the lower flange of two parallel I-Beams. These may be existing roof beams or special beams simply attached to the roof trusses. What will strike every practical man is the reduction of first cost made possible by the elimination of the usual brackets. Another feature is that the stresses on the structure itself are much simplified. Sometimes the wall of a building would carry the crane, crane runway and load vertically, but it is too weak to resist the overturning effect of an ordinary crane carried on wall brackets. Another advantage possessed by the type "S6" crane is to be found in its ability to connect up with a Morris overhead runway. The combination is a source of much time-economy, as it eliminates many useless rehandlings of the load.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.

Board of Water Commissioners, City Council, are having work started at once on construction of Pump Well, estimated to cost $3,500. Chipman & Power, Mail Building, Toronto, are the engineers.

Esquimalt, B.C.

Municipal Council will call for tenders shortly for construction of Sewer, Constance Avenue district, at an estimated cost of $300,000. C. H. Topp, 211 Pemberton Avenue, Victoria, is the engineer, and E. A. Ellis, clerk.

Moncton, N.B.

The Secretary, Dominion Government Department Railways and Canals, L. K. Jones, Ottawa, will receive tenders until October 15th, for construction of Subway under Main Street crossing, 90 ft. long x 30 ft. wide, concrete and steel construction.

Montreal, P.Q.

Board of Commissioners has had surveys completed and tenders will be received by L. N. Senecal, Secretary, after October 16th, for building of Conduit. Plans and specifications are at office of engineer, Mr. Clarkson, 1009 New Birks Building.

City Council has voted $100,000 for construction of Water Mains this year. Mr. Clarkson, 1009 New Birks Building, is the engineer.

City Council has voted $100,000 for construction of waterworks this year. L. N. Senechal is Secretary, and Mr. Clarkson, 1009 New Birks Building, Engineer.

Ottawa, Ont.

Engineer F. C. Askwith has had plans drawn for street grading between Carling and Ernest Streets, at an estimated outlay of $3,000.

City Council has had plans drawn for pavement work, estimated to cost $35,50[illegible], between Queen Street West and Ottawa River. Approximate quantities are: Asphalt, 5,037 sq. yds.; stone blocks, 3,437 sq. yds.; gutter, 3,087 lin. ft., headers, 300 lin. ft.; reinforcing concrete, 25 cu. yds. F. C. Askwith is City Engineer.

City Council has had plans drawn providing for expenditure of [illegible] on solid rock grading on Laurier Avenue, between Percy and Albert Streets, and Edgar, between Irving and Fairmont Avenues.

The following pavement work, estimated to cost $32,500, is to be carried out by City Council between [illegible] and Queen Street West: Approximate quantities: asphalt 9,940 sq. yds.; water table, 2,650 sq. yds.; gutter, 4,500 lin. ft.; headers, 350 lin. ft.

Prince Rupert, B.C.

The Mannesman Tube Company, Limited, 51 Victoria Square, Montreal, which was awarded the contract for 8,000 lin. ft. of 6-in. and 2,000 lin. ft. of 10-in. steel pipe and fittings, have notified City Council that owing to war conditions they are unable to fulfil contract; consequently new tenders may be called. W. McGregor Mason is the engineer, and A. E. Woods, city clerk.

Province of Saskatchewan

Provincial Government Board of Highway Commissioners will commence work immediately on construction of small Reservoirs in various towns. Estimated cost $50,000. F. J. Robinson, Parliament Buildings, Regina, is chairman.

Regina, Sask.

City Council has commenced work on Sewer Extension on various streets involving an estimated outlay of $10,000. R. J. Lechy Company, Limited, 304 Northern Crown Bank Building, are general contractors. F. McArthur, engineer.

Saanich, B.C.

By-law to expend $450,000 on paving and grading work has been passed by Municipality of Saanich. Hector S. Cooper is the clerk.

By-law has been carried to raise $375,000 for construction of Waterworks System and laying of watermains in municipality. Hector S. Cowper is Clerk.

Toronto, Ont.

Commissioner of Works, R. C. Harris, City Hall, has recommended to Board of Control the following works: Concrete sidewalks, $19,090; asphalt pavements, $106,778; concrete curbings, $3,000.

Works Commissioner Harris has recommended that Sewerage and waterworks undertakings estimated to total in cost $1,734,465 be submitted to ratepayers in the form of a by-law. The works are as follows: Asphalt plant, $125,000; drainage for section south of King St., between Bathurst Street and Strachan Avenue, $50,000; detritus chamber for sewage disposal plant, $15,000; laterals for vicinity of Strachan Avenue and [illegible] Eastern Avenue, $46,400; Dundas Street [illegible] supply mains, $525,000; replacing 3-in. and 4-in. mains with 6-in. mains, 70,000 [illegible] service pipes with 6-in. water mains, 10,000 feet, $13,750; six-inch cross connections, 25,750 feet, $42,487; high pressure fire system extension, $500,000; flankage [illegible] extending Bathurst Street main (additionally) [illegible] twelve-inch main—Jane Street, Bloor to [illegible] main—High Park Avenue, Bloor to Dundas Street, [illegible] Carlaw Avenue [illegible] main, [illegible]

Weston, Ont. (Toronto)

Village Council has had plans prepared for construction of Subway at estimated cost of $18,000, to be steel construction. E. A. James, 57 Adelaide Street E., Toronto, is the engineer.

Winnipeg, Man.

Contracts for sidewalks have been awarded by Board of Control as follows: W. C. Woods, Stradbrook Street, at $2,415; Ida Avenue, $584.35; concrete pavement on lane, $1,755.57; J. W. Astley, Engineer of Construction, Woodrow Place, $160.50; Westminster Avenue, $150.50, concrete pavement on lane, $1,552.50; Robert Sharp, 435 Qu'Appelle Avenue, Scott Street, $898.36; H. Galbraith, 666 Pine Street, Young Street, $1,265.

Yorkton, Sask.

The construction of Sewer and Water Mains on Broadway, from Melrose Avenue, to Wallace Avenue and Smith Street, estimated to cost $10,000, is contemplated by City Council. Work will be undertaken by day labor under supervision of H. Talbot Crosbie, engineer. F. J. Pilkington is clerk.

CONTRACTS AWARDED

Collingwood, Ont.

The contract for construction of Concrete Sidewalks has been awarded by Town Council to Wm. Connor, Collingwood, at 12½c per sq. ft.

Eastview, Ont.

Town Council has awarded contract for construction of Concrete Sidewalks on Montreal Road, estimated to cost $8,000, to A. Newlands, Belmont Avenue, Ottawa South. Messrs. Patterson & Byrne, Sparks Street, Ottawa, are the engineers.

Joliette, Que.

The contract for construction of Reinforced Concrete [illegible] alterations to Plant and supply of pumps, in connection with Waterworks Extension Scheme has been awarded by Town Council to [illegible], Joliette, at $33,000. Surveyer & Frigon, 56 Beaver Hall Hill, are the engineers.

London, Ont.

The following contracts for Alterations to Heating Plant have been given out by City Council: General contractor, Jno. Putherborough, 1006 Wellington, [illegible] Incinerator Plant, R. Flett, $1,905, and for general alterations, [illegible]

Regina, Sask.

Sub-contracts as follows have been awarded in connection with City Council's Reservoir Construction Scheme: Supply of Venture Meter, 10 in., for water-main discharging into new reservoir, Francis, Hankin & Company, at $754.30; Manitoba Bridge & Iron Works, Winnipeg, [illegible] Steel [illegible] and Bolts, $8,875, f.o.b. Regina. Work is to be done by day labor. J. M. McKay is the engineer.

Sackville, N.B.

The contract for paving in connection with construction of about 900 feet of 6-ft. concrete sidewalk has been awarded by Town Council to the Sackville Construction Company.

Toronto, Ont.

Board of Control has transferred from Works Department the following contracts: Constructing and Paving Company, Confederation Life Building, asphalt on Gothic, $9,946; St. Clair Avenue, $16,266. Godson Contracting Company, Manning Chambers, asphalt on Coxwell Avenue, $8,535; Langford, $11,827.

West Kildonan, Man.

The general contract for construction of Sewer on Main Street has been awarded by Municipality to Thos. Jackson & Sons, Winnipeg, at $15,478. E. Eatwell, Municipal Hall, is the engineer.

Winnipeg, Man.

Board of Control has awarded the following contracts to J. W. Astley, Engineer of Construction:—Construction of asphalt No. 2 pavement on Oxford Street, from Academy Road to Kingsway, $6,340.50; construction of sewer on Union Avenue, from Wolfe to Grey Street, $1,046.28; construction of asphalt pavements on Newton Avenue, from Strathcona to Montcalm, $9,640; construction of water-main on Ingersoll Street, from St. Matthews Avenue to 500 ft. South, $135.36; construction of water-mains on Powers and Parr Streets, $192.24; construction of water-mains on Main Avenue, from Grey to Green Street, $460.25; construction of sewer on McAdam Avenue, from Main Street to South end of Avenue, $217.60; construction of water-main on Garwood Avenue, $219, and paving at $1,531.20. W. P. Brereton, 233 James Avenue, is the engineer.

The following contracts have been awarded by Board of Control for paving work: E. F. Campbell, Superintendent of Construction, Macadam pavement of Blanchard, $977.15; Thos. Jackson & Sons—Granolithic sidewalks on Martin, $794.42; Westminster, $217; Young Street, $281.40, and Balmoral, $240.20.

Contracts have been awarded as follows in connection with sewerage construction: Dominion Construction Company—Levis Street, at $371.50; Thos. Jackson & Sons—Manhattan Avenue, $819.50; Dominion Construction Company, Agnes Avenue, at $2,071.35; J. W. Astley, Engineer of Construction, Oak Street, at $540.90.

Railroads, Bridges and Wharves

Edmonton, Alta.

C. P. R. Construction Department has commenced work on construction of line from Monitor to Kerrobert. Mr. McGregor, C. P. R. Building, is superintendent.

London, Ont.

London and Port Stanley Railway Company is having steel laid in connection with construction scheme. Overhead work will be started next spring.

Ottawa, Ont.

City Council has authorized Archie Currie, City Engineer, to invite tenders at once for construction of Steel Bascule Bridge, estimated to cost $120,000, on Pretoria Avenue.

Province of Saskatchewan

Work is to start immediately on construction of a number of Bridges for Provincial Government Board of Highway Commissioners. Work is to be done by day labor and is estimated to cost approximately $50,000. F. J. Robinson, Parliament Buildings, Regina, is chairman.

Quebec, Que.

Mr. Harry Edward Prindle, architect, is preparing plans for the new Union Station at Quebec, Que., for the Canadian Pacific Railway.

St. Catharines, Ont.

Tenders are being received by J. A. Pay, City Clerk, in connection with construction of superstructure for High Level Bridge across St. Paul Street. Plans and specification are at office of engineer, W. P. Near.

St. Johns, N.B.

St. John Street Railway Company is extending its present system to Marsh Road. Work, which will be done by day labor under supervision of owner, has been started.

Toronto, Ont.

Plans have been drawn for construction of bridge on Clarence Avenue for Estates Limited. Bridge will be one-span, approximately 100 ft., wooden construction and work will be done by day labor under supervision of Engineer Frank Barber, 57 Adelaide Street East.

CONTRACTS AWARDED

Brantford, Ont.

Preston Car & Coach Company, Preston, has been awarded contract in connection with construction of line from Galt to Brantford for Green Valley Railway Company, at $25,000. Entire scheme will involve an outlay of $253,000.

Public Buildings, Churches, and Schools

Berthier, Que.

Provincial Government, Quebec, has had plans drawn for 2½-storey, 60 x 31, School. Estimated cost $4,000. E. Charest, Parliament Buildings, Quebec, is the architect.

Elmira, Ont.

St. Paul's Lutheran Church is contemplating the purchase of colored glass for Church windows, also electric pipe organ blower with motor. Geo. Lunge is the secretary.

General contractor, E. A. Bleakney, Arthur Street, is receiving prices on painting, glazing, electrical work and tiling in connection with $40,000 Post Office in course of erection on Arthur Street, for Dominion Government Department of Public Works. Building will be three storeys, 122 x 66, pressed brick construction.

Hespeler, Ont.

The following contracts have been awarded by Town Council for Town Hall, 70 by 55 ft., artificial stone construction, estimated to cost $35,000: General contract, masonry and plastering—Grill Bros., Queen Street; Carpentry, Prestien & Bartels, Cooper Street. Work will commence at once. Evans & Fulford, Scott & Bennett Block, are the architects.

Isle Bizard, Que.

General contract for alterations to Presbytery Parish of St. Raphael, near Beaconsfield, at an estimated cost of $5,000, has been awarded to Martin & Theoret, Lachine. L. J. Bigonnesse, 92 Notre Dame East, Montreal, is the architect.

Kildonan, Man. (Winnipeg)

Work in connection with three Schools for Kildonan School Board has been suspended temporarily, but will be resumed shortly. Sutherland Construction Company, Winnipeg, are the general contractors. No sub-contracts have yet been awarded.

Lakefield, Ont.

Sub-contracts for heating and plumbing in connection with construction of Post Office, etc., for Dominion Government Department Public Works, have been awarded to William Hungerford, Colborne Street, Lindsay. Building will be two storeys, basement and tower, stone and brick, structural steel.

London, Ont.

E. R. Dennis, Chairman, Board of Education, is taking prices on desks, cabinets and library stacks. Tenders will be called shortly for gymnasium equipment. R. M. McElhearn is secretary.

Maisonneuve, Que. (Montreal)

In connection with construction of Fire Hall and Police Station at estimated cost of $70,000, on Letourneau and Notre Dame, Marins Dufresne, Ontario Street, Architect, will call for tenders on carpentry in a few days. Building will be 2½ storeys, 167 x 40.

Milltown, N.B.

Sub-contract for roofing Post Office and Customs House for Dominion Government Department Public Works, has been awarded to John E. Wilson Company, Sydney Street, St. John, N.B.

Montreal, Que.

The following contracts have been awarded in connection with construction of $200,000 Club House, Cherrier Street, for National Amateur Athletic Association: Concrete work—O. Filion & Freres, 869 De St. Valier Street; steel, Phoenix Bridge & Iron Works Company, Limited, 83 Colborne Street. The architects are J. A. Ouellet, Dandurand Building, and J. O. Turgon, 55 St. Francois Zavier Street. Foundations and steel work only will be done this year; other contracts will be awarded next spring. Building will be four storeys, 110 x 106.

Markdale, Ont.

Town Council will require interior fittings in connection with $7,000 Library in course of construction.

Norwood, Man.

Village Council contemplate taking tenders next year for construction of Library estimated to cost $3,500. E. J. Larry is the Clerk. Building will be brick and concrete.

Navan, Ont.

New tenders will be received by Jas. Cotton, Navan P. O., Se. Cumberland School Board, No. 3, until October 17, for supply of materials and erection of 4-roomed School, solid brick construction, concrete foundation. Plans and specification are at office of architects, Messrs. Richards & Abra, 216-220 Booth Building, Ottawa.

Ottawa, Ont.
By-law has been carried by ratepayers to provide new set of pumps for Lemieux Island Pumping Station. Tenders have not yet been called.

Port McNicoll, Ont.
Hydro Commission has started work on erection of service lines for town. Requirements will include a quantity of fixtures for residence and stores. Mr. James is the engineer-in-charge.

Quebec, Que.
Tenders for interior fittings in connection with $60,000 Board School in course of construction for Bon Pasteur Convent, St. Amable Street, will not be called until next June. Architects, Messrs. Tanguay & Lebon, 20 D'Aiguillon Street.

Rothsay, N.B.
Architect G. E. Fairweather, 84 Germain Street, St. John, is preparing plans for School Building erected by New Brunswick School Board. Dr. W. S. Carter, Fredericton, is Chief Superintendent of Education.

Starview, Sask.
Red Cross S. D. No. 3245 has been authorized by Saskatchewan Local Government Board to raise funds for erection of School. E. S. Welch, Starview, is secretary-treasurer.

St. Simeon, Que.
Parish of St. Simeon has plans in progress for Church, and tenders will be called some time in December. Ouellette & Levesque, 115 St. John Street, Quebec, are the architects.

St. Jacques, Que.
R. C. Church, together with stores occupied by J. O. Lasalle and M. Meiancon (dry goods), Jos. Duga (barber), have been destroyed by fire. All buildings were insured and Church body (owners), will rebuild.

St. Luc, Que.
Plans are in progress by R. P. Lemay, 19 D'Aiguillon Street, [illegible] construction of Church for parish of St. Luc.

Simcoe, Ont.
It is stated that the Board of Education will require interior equipment, consisting of desks, blackboards, etc., in connection with alterations to School on Lynwood Avenue. J. D. Larson is chairman.

Toronto, Ont.
The Storey Pump & Equipment Company, Limited, Kent Building, Toronto, have been awarded the contract for Pumping Machinery [illegible] Strachan Callege, including Deane Steam Pumps and Morris Centrifugal Circulating Pumps with Steam Turbines.

Board of Education [illegible] the following contracts, amounting to $162,014, in connection with construction of Givens Street School, [illegible] construction, steel [illegible], etc. [illegible] Albert Webb, $95,900; carpentry, Crocker & Ledrew, $29,500; roofing, W. E. Dillon Company, Limited, $1,755; two concrete floors, A. C. Richmond, $3,700; plastering, Haddock & Son, $7,595; iron stairs, Canadian Ornamental Iron Company, $6,359; painting, Jos. Phinnemore, $3,725; wiring, F. Armstrong Company, $648; plumbing and heating, Purdy-Mansell, Limited, $23,480. Contract for heat regulation has not yet been awarded.

Truro, N.S.
First Presbyterian & St. Paul's United Congregation are now doing construction work on $60,000 Church, Prince Street, former general contractor having given up business. Building will be structural steel, pressed brick and Pictou stone construction. Currie & Sparling, 105 Bond Street, Toronto, are architects. W. J. Murray is Chairman of Building Committee.

Welland, Ont.
High School Board is purchasing School Furniture for High School on West Main Street, 2 storeys and basement, 170 x 80, hollow tile and brick construction. D. F. Forbes, Temple Building, is the architect and Wm. H. Lowe, secretary.

CONTRACTS AWARDED

Regina, Sask.
The following sub-contracts have been awarded in connection with construction of $90,000 Power House for City Council Light & Power Department:—10 h.p. Motor to operate Turbine Condenser, Ferranti Electrical Company of Canada, Limited, Winnipeg; Pipe connections for same, Crane & Ordway Company, Winnipeg.

Business Buildings and Industrial Plants

Beaufort, Que.
Residence, barns, cattle and farm implements, the property of Jos. Dubeau, have been destroyed by fire, and loss of $7,000 sustained. Property was insured. Owner will rebuild and purchase new machinery.

Calgary, Alta.
Thomas-Jamieson McKenzie, 307 Travis Building, have been awarded general contract for construction of $35,000 Warehouse on 11th Avenue, two-storey and basement, 100 x 100, brick construction, for Simington Grocery Company, 8th Avenue. Work will commence immediately.

Chilliwack, B.C.
Rockwell, Theal & Davidson, owners, have had plans drawn by Norman J. Hall, architect, Vancouver, for Grain Elevator, mill and corrugated iron construction, [illegible] Machinery will also be installed. W. H. Davison, North Vancouver, will be Building Superintendent.

Essex, Ont.
W. A. McConnell has in contemplation the construction of white brick store estimated to cost $10,000.

The erection of store, white brick con[illegible] estimated to cost $8,000, is contemplated by W. H. Richardson.

Galt, Ont.
[illegible] decided that they will not build factory [illegible] building.

Harvey Station, N.B.
Residence and barn owned by Roy Little, has been destroyed by fire, incurring loss of about $3,000. Owner will rebuild.

Ingersoll, Ont.
Evaporator owned by O. E. Robinson & Company, Fruit Warehouse, Victoria Street, has been burned down. Loss estimated at $4,000 is partially covered by insurance.

London, Ont.
Victor Amusement Company, Limited, has purchased site and intends erecting Theatre with seating capacity of 1,000, also site for Dance Hall, 60 ft. in diameter. Geo. L. Jackson, 87 Wellington Street, is interested. Architect has not yet been appointed.

International Fire Works Company of Canada intends erecting factory at London Junction, for the manufacture of fireworks. Work is expected to begin about October 15th.

Montreal, Que.
Plans are in progress and Aquin & Brault, 908 New Birks Building, will call for tenders immediately in connection with proposed alterations to stores on Notre Dame West, estimated to cost $5,000, for Mr. Payne, owner.

Site has been bought and Blondin and Carbell, 1211 St. Catherine East, Montreal, contemplate construction of annex to stores on Park and Bernard Streets.

Business block owned by Waste and Metal Company, 223 Wellington, and occupied by Dominion Machinery Supply Company, Canada Steel Products Company, and Industrial Manufacturing Company, has been destroyed by fire.

Moncton, N.B.
Plans are in progress for $5,000 addition to Bank of Nova Scotia, Main Street, G. E. Fairweather, 84 Germain Street, St. John, is the architect.

New Westminster, B.C.
It is announced that Salmon [illegible] Lumber & Shingle Company, Limited, 198 Hastings Street, Vancouver, will start operations next spring on rebuilding Lumber Mill. Estimated cost $40,000.

Newmarket, Ont.
Tenders close with Burke, Horwood & [illegible]ronto, on October 15th, for construction of one-storey brick gymnasium, estimated to cost $5,000, for Pickering College. W. P. Firth is the Principal.

Niagara Falls, Ont.
[illegible] of Hamilton, Queen Street, has had plans drawn by Mills & Hutton, Hamilton, Ont., architects, for construction of one-storey, 60 x 30, bank building, brick construction, estimated to cost $16,000. J. H. Stuart is the manager.

Ottawa, Ont.
The erection of stores and apartments on Market Street, is contemplated by A. [illegible]

City Council [illegible] contemplation [illegible] Market Buildings at estimated cost of $15,000. W. E. Noffke, 45 [illegible] Street, will be the [illegible]

[illegible]

[illegible] for Stores and Apartments on Market Street, estimated to cost $7,500. A. [illegible], 115 Goulbourn Avenue, is [illegible] and buildings will be 36 by 85 ft., [illegible] brick construction.

Quebec, Que.
F. & R. Blouin, Colomb Street, are erecting Shoe Factory on Colomb Street, at estimated cost of $3,000. Old building has been razed. General contractor, Edward Paquet, Couillard, Que.

Smiths Falls, Ont.
Dominion Government Department Public Works, has obtained site for 20 by 106 ft. Armoury, estimated to cost $60,000.

Toronto, Ont.
Tenders are wanted on plumbing, heating, electric wiring, iron cornices, gutters, etc., in connection with construction of Stores and Apartments on Roncesvalles Avenue for W. J. S. Themaine, 171 Keele Street. Buildings will be three storeys, 130 x 56, brick construction and estimated to cost $30,000.

Work which was temporarily suspended on $100,000 six-storey Office Building on Yonge and Albert Streets, for John Stark & Company, 26 Toronto Street, has been resumed. Building will be steel, terra cotta and brick construction.

Sub-tenders are invited by Raymond Construction Company, 43 Victoria St., on Dairy Building, 3 storeys and basement, 90 x 106½, and stables, 3 storeys, 132 x 106, to be erected on Walmer Road and Bridgman for Farmers Dairy Company, Limited, 367 Queen Street West. Time is extended indefinitely for all trades.

Raymond Construction Company also invite sub-tenders on Office Building for Provincial Hydro-Electric Commission of Ontario.

Permit has been issued to M. Libby, 214 Bathurst Street, for construction of $3,000 factory, one storey, 25 x 46, brick construction.

General tenders will be received until October 19th by Provincial Hydro-Electric Commission (W. W. Pope, Continental Life Building, Toronto, Secretary) for construction of Office Building on University Avenue, at estimated cost of $300,000. Building will be steel, brick construction. Sub-tenders are invited by Harris & Harris, 110 Church Street. Jackson, Lewis Company, Bell Telephone Building, Adelaide Street W.; Sutherland Construction Company, Ryrie Building; and the John H. Parker Company (Canada), Limited, 8 Colborne Street.

Tenders are invited at once on heating and plumbing for three-storey, 34 x 48, terra cotta and brick factory, being constructed on Morrison Street, for owner and general contractor, J. Gingras, 459 Adelaide Street W. Estimated cost $14,500.

Walkerville, Ont.
The Garden Theatre Company of Ontario, who contemplated the building of $25,000 Theatre at Walkerville, has decided not to build at present.

Winnipeg, Man.
Lumber mill owned by J. D. McArthur Lumber Company, and valued at $125,000, has been destroyed by fire at Lac du Bonnet.

CONTRACTS AWARDED

Montreal, Que.
Joseph Viau & Company, 87 St. Andre Street, have obtained contract for addition and alterations to Picture Theatre on St. Lawrence, estimated to cost $8,000. Building will be 90 ft. high, 40 x 45, stone, brick and steel construction. F. T. Jackalin, Room 5, Jacobs Building, is the architect.

Ottawa, Ont.
The general contract for alterations to Store on Laurier Avenue W., for A. A. Fournier, 327 Wellington, has been awarded to Geo. Eaman & Son.

St. Catharines, Ont.
Contracts have been awarded as follows for construction of $10,000 Store on St. Paul Street West, for Woolworth Company, Limited, Yonge and Queen Streets, Toronto, owner and architect. General contractor, Frank Roberts, Hamilton; carpentry, Guy E. Montrose, Hamilton; steel, Hamilton Bridge Company. Building will be two-storeys, 100 by 30 feet, steel and brick construction.

St. John, N.B.
The general contract for addition and alterations to Store and Stables at an estimated cost of $35,000, for Salvation Army, 255 Prince William, has been awarded to E. W. Green, Tisdale Place. Work is to commence immediately.

Windsor, Ont.
The contract for $2,000 Garage on Victoria Avenue, for Dr. J. S. LaBelle, London and Ouellette Streets, has been awarded to Arthur Sebley, 42 Elliott Street. Atcheson & Adams, LaBelle Building, are the architects.

Residences

Maisonneuve, Que. (Montreal)
Tenders are to be called about October 20, for contract to construct $15,000 Residence on St. Catherines Street, for St. Lawrence Sugar Refineries, Limited. Hutchison, Wood & Miller, Royal Insurance Building, are the architects.

Montreal, Que.
Plans have been drawn for alterations to three flats on Sherbrooke West for Royal Tunnel & Terminal Company, 411 Dorchester Street West. E. Gordon Mitchell, 4 Beaver Hall Hill, is the architect and MacKenzie Mann & Company, 411 Dorchester Street West, are the general contractors.

C. C. Cottrell, Limited, 532 St. Catherine West, are having plans prepared for construction of fifteen Residences at Pine Beach. Aquin & Brault, 908 New Birks Building, Montreal, are the architects.

Niagara-on-the-Lake, Ont.
Mrs. Charlotte Prince, Chalaqua Grove, has the erection of a residence in contemplation.

Notre Dame de Bois, Que.
The residence of Henri Demers has been destroyed by fire. Loss estimated a $6,000, is partly covered by insurance. Owner will rebuild.

Ottawa, Ont.
The construction of Residences on Concord Street, two-storeys, 21 by 38 ft., brick veneer construction, is contemplated by John Hay, 13 Central Street.

Outremont, Que. (Montreal)
Tenders are to be called in less than two weeks by architects, Aquin & Brault, 908 New Birks Building, Montreal, for alterations to Residence of J. A. Guimond. Estimated cost $8,000.

Port McNicoll, Ont.
Tenders are open for plastering, painting, heating, plumbing, electrical work and interior fittings in connection with construction of two-storey Milton pressed brick veneer residence, for Captain MacIntyre, R. S. S. Manitoba.

Quebec, Que.
Owner and general contractor, Pierre Savard, 788 Montcalm, is receiving tenders for heating, plumbing, electrical work and roofing, also for material for plastering and painting, in connection with $5,000 residence on Cartier Avenue.

Tenders are invited on roofing, painting and electrical work in connection with $6,000 residence for M. Desrochers, 550 St. Francois Street.

Owner and general contractor, Gaud Pare, 7 La Liberte, invites tenders for masonry, roofing, painting, plumbing and electrical work on three-storey frame and brick Residence. Estimated cost $7,000.

Tenders are called for masonry, roofing, plastering, painting, heating, plumbing and electrical work in connection with three-storey brick and frame Residence for J. C. Lacroix, 192 Dorchester. Estimated cost $5,000.

Toronto, Ont.
M. Healy, 153 George Street, owner and general contractor, will sub-let some trades in connection with $12,000 Detached Residence, 2½ storeys, 36 by 40 ft., brick construction, on High Park Boulevard. J. Thomson, 43 Victoria St., is the architect.

Tenders will be called by J. M. Heale, 61 Oakmount Blvd., about November next, for construction of two 2½-storeys, 30 x 80, brick Residences on Oakmount Road, at estimated cost of $12,000. Angus & Angus, Sudbury, Ont., are the architects.

Winnipeg, Man.
Foundation work only will be carried out this year on $10,000 Residence for Genser Bros., 97 Lusted Street, owners and general contractors.

CONTRACTS AWARDED

Montreal West, Que.
The general contract for constructing $10,000 brick and stone Residence on Brock Avenue, for H. E. Stephenson, has been awarded to J. D. Kirkpatrick, 37 Fenwick Avenue. The architects are Peden & McLaren, 20 St. Alexis Street, Montreal.

Ottawa, Ont.
The general contract for Residence for Mrs. E. Patton, 139 Preston Street, has been awarded to R. G. Smith, Thornton Avenue.

Power Plants, Electricity and Telephones

Chatham, Ont.
City Council has submited by-law to ratepayers to raise $90,000 for installation of Hydro-Electric System. W. G. Merritt is the City Clerk.

London, Ont.
Tenders will be called shortly for two

Motor Generator sets, 1,500 volts, direct-current, complete with switches, also 13,000-volt, 25-cycle transformers, for City Council. H. J. Glaubitz, City Hall, is the engineer.

Simcoe, Ont.
Plans for Hydro Station on Pond St., 18 ft. high, brick construction, have been completed, and Town Council will invite tenders shortly. Work will start immediately on installation of 8 miles of line. W. C. McCall is the Town Clerk.

Stettler, Alta.
Town Council and ratepayers have passed by-laws for Extension to Waterworks ($8,000) and Electric Light System ($,000). J. Jamieson is the Engineer.

Winnipeg, Man.
Canadian Westinghouse Company, Limited, Portage Avenue East, has been awarded the contract to supply six oil Circuit Breakers, electrically operated, for Power House at Point du Bois. Contract price $6,000.

CONTRACTS AWARDED

Montreal, Que.
The contract for supplying one horizontal boiler of 500 h.p., one vertical of 350 h.p. with fittings and appurtenances complete, has been awarded to Wilkes Bros., Saginaw, Mich., at $19,000, by Board of Commissioners.

Miscellaneous

Fernhill, Ont.
Gordon Moore, Ailsa Craig P. O., Ont., will be in the market shortly for Cement Supplies for manufacturing tile and concrete blocks at Fernhill, Ont.

Mount Forest, Ont.
The Gibson Furniture Company, Main Street, is purchasing a quantity of woodworking machinery.

Toronto, Ont.
Mr. A. Shanks, 50 Peterboro Avenue, is opening hardware store on Bloor Street West, and desires prices and catalogues, etc., for supply of stock.

New Companies

The Clifton Stone & Gravel Corporation, Limited, have been incorporated as dealers in stone and gravel, etc., and manufacturers of lime and cement brick. Head office is at 8 King Street W., Toronto. Capital $150,000.

Candian Road Contractors, Limited, has been incorporated with a capital of $500,000 to conduct general engineering and construction business. Head office will be at Montreal and Francois X. Gagnon, 109 University Avenue, is interested.

[illegible] Limited, has been incorporated as a mining company with power to conduct general mining business. The headquarters of the company will be Haileybury, Ont. Capital, $50,000.

Canadian-American Graphite Company, Limited, has been incorporated for general mining and smelting business, with head office at Prescott, Ont. Capital, [illegible].

Sidney Island Brick & Tile Company, Limited, has been incorporated with a capital of $150,000, with head office at Victoria, B.C. Company has authority to manufacture brick, tile, terra cotta, etc.

Caspedia Booming Company, Limited, has been incorporated with power to construct dams, piers, etc. Capital, $50,000. Head office, New Richmond, Que.

Fraser, Brace & Company, Limited, has been incorporated, with chief place of business at Montreal, and $100,000 capital, as a general contracting and construction company.

The Similkameen Consolidated Copper Company has been formed at Princeton, B.C., with a capital of $2,000,000. W. S. Ayres, Hazelton, Pa., U. S. A., is President and Engineer.

The Ottawa Lead and Zinc Mining Company, Limited, has been incorporated with a capital of $300,000, and head office at Arnprior, Ont. Company will conduct a general quarry and mining business.

The Sherwin-Williams Company of Canada, Limited, whose head office is at 897 Centre Street, Montreal, has been licensed to carry on business as manufacturers and dealers in paints, polishes, stains, etc ., in British Columbia. Head office is at 827-31 Powell Street, Vancouver.

The Imperial Pipe Laying Company, Limited, has been incorporated as a minnig concern with capital stock of $1,000,000. Sarnia, Ontario, is the company's headquarters.

The Ottawa Lead & Zinc Mining Company, Limited, has been incorporated with head office at Arnprior, Ont., and capital stock of $300,000. The company will construct bridges, reservoirs, aqueducts, warehouses, etc.

Jacob & Valentin, Limited, has been incorporated a Construction Company with capital stock of $50,000. Head office will be at Montreal.

Sarnia Metal Products Company, Limited, has incorporated with $100,000 capital. The chief place of business is Sarnia, Ont., and the Provisional Directors are Morris S. Babcock, Malcolm MacKenzie, Lloyd Lott, Angus McDonald, Lott and Robert Irwin Towers.

Warwick Wheel Company of Canada, Limited, has been incorporated with $100,000 capital. Messrs. C. W. Summers, 433 Hamilton Road, and G. A. McLachlan, 45 Ridout Street, are interested.

Port Colborne Development Company has been incorporated with power to build houses, etc., with a capital of $50,000.

The Regina Cold Storage & Warehouse Company, Limited, has been incorporated with capital of $50,000.

Canyon City Saw Mills Company, Limited, has been incorporated with capital of $15,000. The company has also acquired a site for lumber yards and coal sheds at Innismore.

The Great Western Furniture Company, Limited, has been incorporated. Capital $50,000.

Planet Elevator Company, Limited, is a recent incorporation with a capital of [illegible].

The Imperial Pipe Line Company, Limited, has been incorporated with head office at Sarnia, Ont., to conduct general oil refinery, operate and maintain pipe lines, etc. The new company has a capital of $1,000,000.

Toronto and Canadian Building Company, 41 Adelaide Street E., Toronto, has been incorporated with $40,000 capital, with power to conduct general building business and deal in all building materials.

Blairmore Coal Lands, Limited, an Extra-Provincial Company, has been licensed to carry on business as brickmakers, miners, etc. The head office in the Province is at the Metropolitan Building, Vancouver, and the capital $500,000.

The B. C. Sheet Metal Works, Limited, has been incorporated with a capital of $10,000. The head office is at Vancouver, and the company will trade as iron founders, mechanical engineers, manufacturers of implements and machinery, builders, electrical engineers, etc.

Franklin Automobile Company, an Extra-Provincial company, has been registered and authorized to carry on business within the Province of British Columbia as manufacturers of motor and other vehicles, etc. The head office of the company in the Province is at London Building, 626 Pender Street West, Vancouver, and the capital $400,000.

S. Caulfield & Sons, Limited, has been incorporated with $40,000 capital, and head office at Toronto, as builders and dealers in building supplies, etc.

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

IRON Fences, Wire Fences, Gates, Fire Escapes, Jail Cells, Office Wirework, Wire Baskets, and all kinds of Builders' Wire and Ironwork.

THE PAGE WIRE FENCE CO.
LIMITED
Walkerville, Toronto, Montreal, St. John

SIMPLE
IAPHRAGM PUMPS
WITH IMPROVED VALVES
(Patented)
[illegible]
RELIABLE
HONIG & MOCK, Ltd.
7, MARK LANE, LONDON
ENGLAND.
"The Pump for Emergencies"

Tenders and For Sale Department

Tenders for One Overhead Hand-operated Traveling Crane

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, October 27th, 1914**, for the supply of one Overhead Hand-operated Traveling Crane.

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Estimating and Accounting Section of the Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering, as prescribed by City By-law, must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof the bond of a Guarantee Company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
October 2nd, 1914. 41

Temiskaming & Northern Ontario Railway Commission

Tenders for Restaurant Privileges

Sealed tenders (which must be separate for each restaurant) addressed to the undersigned and endorsed "Tender for Restaurant Privileges," will be received at the office of the Commission, 25 Toronto Street, Toronto, up to 12 o'clock noon on **Thursday, the 22nd day of October, 1914**, for the restaurant privileges for five years at each of the following places, (such privileges to become effective from the dates hereinafter mentioned).

Timagami from February 10th, 1915.

Englehart from November 1st, 1914.

Cochrane, when open.

Each tender must be accompanied by an accepted cheque upon a chartered bank of Canada payable to the order of the Commission for ten per cent. of the amount of such tender.

The restaurants at Englehart and Cochrane will be heated by the Commission but at Timagami the party whose tender is accepted will be required to furnish the necessary heating.

In the case of each restaurant the party whose tender is accepted will be required to promptly execute a lease in form satisfactory to the Commission, failing which his cheque will be absolutely forfeited to the Commission and if deemed necessary, by the Commission, he shall also furnish a bond satisfactory to the Commission for the due performance of such lease.

The cheques sent in by unsuccessful tenderers will be returned to them.

The Commission does not bind itself to accept the highest or any tender.

For further particulars apply to the undersigned.

Dated at Toronto this 1st day of October, A. D. 1914.

A. J. McGEE,
40-41 Secretary-Treasurer.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, October 27th, 1914**, for the construction of the following sewers, viz.:

Bridge St., Norwood Road to Main Street.
Cedarvale Ave., Danforth Ave. to N. City limit.
Costain Ave., McMillan Ave. to Morton Road.
Darrell Ave., Woodbine Ave. to Colfview Ave.
Doel Ave., west limit lot No. 23, plan 381, to east limit lot No. 29, plan 381.
Eastern Ave., Knox Ave. to Morley Ave.
Evelyn Ave., Glenholme Drive to Glendonwynne Road.
Fawcett Ave., Gerrard St. to G. T. R.
Gledhill Rd., Danforth Ave. to north City limit.
Golfview Ave., **Danforth Ave.** to G. T. R.
McMillan Ave., Gerrard Street to G. T. R.
Morton Road N., Gerrard Street to north end.
Normandy Blvd., Patricia Rd. to Gerrard St.
Palmer Ave., Balfour Ave. to north City limit.
Sparkhall Ave., Logan Ave. to 646 feet west.
St. Clair Ave., Runnymede Rd. to 2950 ft. west of Keele Street.
Wheeler Ave., 1720 ft. north of n.s. Queen Street to north end.
Williamson Road, Glenmanor Drive to Pine Crescent.
Woodlee Ave., Gerrard Street to north end.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tender obtained, at the office of the Commissioner of Works. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid. Conditions relating to tendering as prescribed by City By-law must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, October 7th, 1914. 41

Sales Agents Wanted

Large United States chain manufacturers now represented in Quebec Province want to secure Sales Agents in Ontario, Western Canada and Maritime Provinces for all kinds of logging chain, dredging chain, etc. Apply Box 78, Contract Record, Toronto, Canada. 39-41

CAPITAL introduced for sound enterprises of all kinds. 5 per cent. commission. Bond and stock issues placed. Underwriting procured. References exchanged. Address Cooke & Byrne, Harcourt Street, Dublin, Ireland. 40-45

Late News Items

Brantford, Ont.

A joint conference has been arranged between Board of Works and Parks Board to investigate question of constructing park driveway and boulevard, 17 miles long, through the city.

Quebec, Que.

The construction of National Transcontinental line from Quebec to Superior Junction has been completed and will be ready for operation in November.

Regina, Sask.

City Council has granted permission to lay steel pipes under lane west of building on 12th and Scarth Streets, to heat Aldon Block. Owner, McCallum-Hill Company, Limited, McCallum-Hill Building.

Saanich, B.C.

Ratepayers have carried by-laws to expend $375,000 on Waterworks Distribution system for municipality.

Toronto, Ont.

Police station will probably be erected next year on site of present Wilton Avenue fire hall.

Proportions of cost as between city and C. P. R. in connection with construction of Yonge Street subway will be determined by Railway Board.

Tenders will be received until October 27 for overhead hand-operated travelling crane. Specification at Room 12, Works Department, City Hall.

Tenders are being received by owner, R. Clayton, 731 Shaw Street, C. 1785, for roofing, plastering, painting, heating, plumbing and electrical work in connection with Residence on 543 Delaware Avenue.

Special Committee representing different municipalities decided to request Provincial Government to make survey of Highway with a view to construction of permanent roadway from Toronto to Oshawa. An estimate of cost of 16 ft. concrete roadway with gravel shoulders and concrete base is also to be made.

It is reported that construction of Union Station and Railway Viaduct at Toronto is being financed from England and New York, and that work will proceed in near future.

Vancouver, B.C.

Plans have been completed by Department of Public Works, Ottawa, for Government Elevator to be erected on site of dock. As soon as specifications have been completed tenders will be called. Proposed structure will have capacity of 1,500,000 bushels.

Plans are being prepared by municipal engineer for water system for West Vancouver. A pipe line will be built up Sister Creek, about three miles from water front, which will require 20 miles of steel pipe. A dam will also be constructed with a capacity of 2,000,000 gal.

Building Inspector Hubbard, South Vancouver, has completed plans for proposed Fire Hall to be erected on site adjoining Municipal Hall. Tenders will be invited shortly.

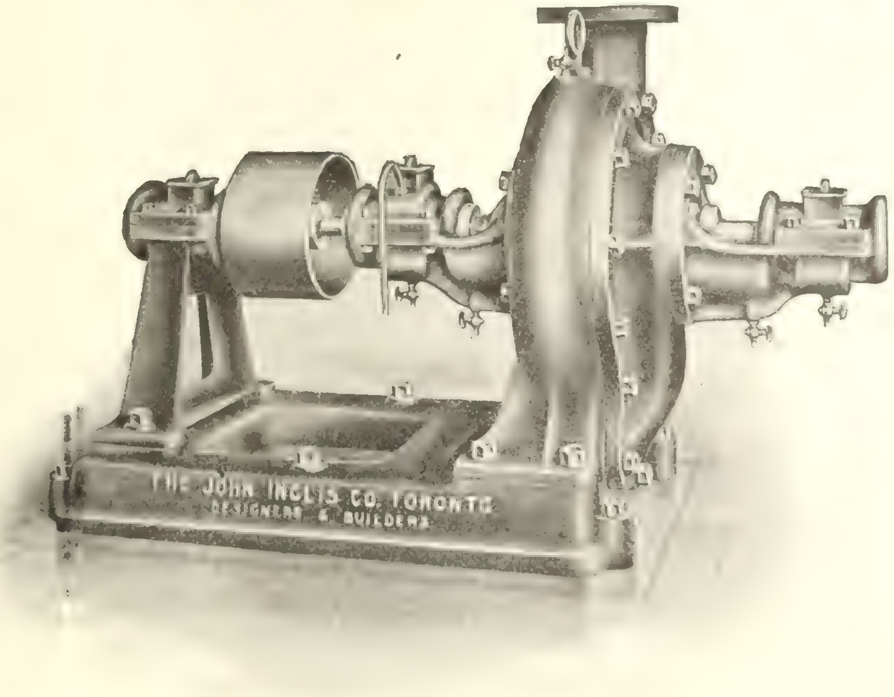
Colonial Brewing Company will erect a $300,000 brewery in Vancouver.

Plans prepared by City Engineer reported approved by Board of Works, Ottawa, for constructing sea wall along False Creek, cost about $65,000.

York Township, Ont.

North Earlscourt and Fairbank Ratepayers' Association have requested Council of York Township to proceed with sidewalks from Kitchener Avenue to Club House.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

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14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

FOR SALE

One —55 Ton Switching Engine
One —35 Ton Vulcan Dinkey
Three—25 Ton 12 x 18 American Locomotive Co. Dinkies
Three—25 Ton 12 x 18 Vulcan Dinkies
Five —25 Ton Porter Dinkies
Two —10 x 16 Standard Gauge Vulcan Dinkies
One —10 x 16 36″ Gauge Porter Dinkey
Eighty—6 Yard K. & J. Dump Cars
Twenty—6 Yard Continental Dump Cars
Ten —4 Yd. Continental Dump Cars, 36″ gauge
Two Model 60 Marion Shovels
One —75 Ton Marion Shovel with extra high lift Boom
Two —Stone Crushers

Motors, all sizes, from 15 to 200 H.P., 3 phase, 440 volts to 2200 volts.

W. FRASER,
83 Craig St. W. MONTREAL

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario

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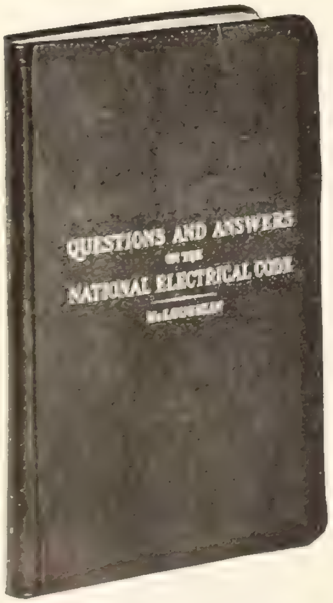

Questions and Answers on the National Electrical Code

It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.
The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 net, prepaid.

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Universal Form Clamp

Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

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Standard Bank Building, Toronto
Agents for Ontario and Eastern Canada

—Montreal representatives—
RAMSEY & KELLY, 511 Quebec Bank Building

Buy the Brick
of
Proven Merit

By actual use in many structures and by scientific tests Harbour sand lime bricks have been proved an ideal building material.

Tests made at the University of Toronto at different times showed the crushing strength in pounds per square inch as: 4180, 4020, 4050, 4130. This is proof of uniformity in strength.

Harbour Brick Co., Limited
Lumsden Building
Toronto

Aikenhead's

No. 408 Contractor's Forge

Full Line Blacksmith's Tools

This forge is very strong and durable specially adapted for general blacksmith work It is equipped with No. 400 Blower, Whirlwind Tuyere Iron, and Half Hood, Hearth 30 x 36 in., Height 30 in., Weight 300 lbs.

Genuine Peter Wright Anvils and Leg Vises.

Aikenhead Hardware Limited, 17 Temperance Street
TORONTO

Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed complete.

WATER TANKS
all sizes.

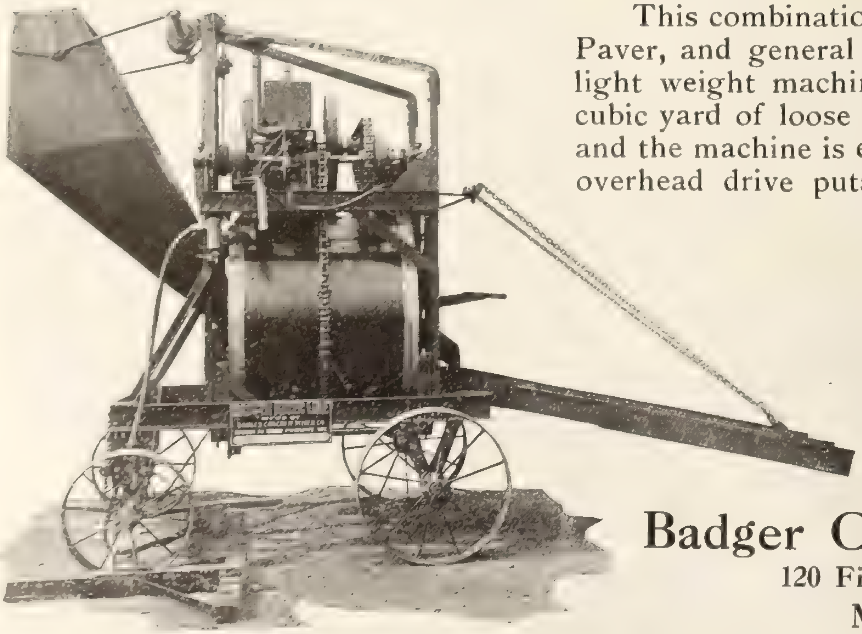
Write for prices.

Manufactured by

Canadian Pipe Co., Limited

Factory : 550 Pacific St., VANCOUVER, B. C.

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

Badger Concrete Mixer Co.

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Milwaukee, Wis.

The Canadian Architects, Engineers and Master Builders
Recognize

Bay State Brick and Cement Coating

As the Standard Coating for the Protection and Decoration of Concrete, Brick, Plaster and Stucco Surfaces.

Exteriors treated with our coating are made damp-proof, thus preventing hair cracking, also discoloration of both interior and exterior surfaces caused by moisture corroding the metal lathing.

Write to-day for our newly issued Booklet No. 10.

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We also build

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to support them.

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MacKinnon, Holmes & Company Limited
SHERBROOKE, QUE.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

[illegible] in 5 barrel lots, $1.85 per bbl., [illegible] $1.65 on the track, with pkgs. $1.95.

Lime—[illegible] 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the [illegible] white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-[illegible] brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for [illegible]

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$4.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 65c.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals). Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1 in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; Bsitish manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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REPRESENTING

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The Exeter Machine Works, Pittston, Pa. Electric Overhead and Travelling Cranes, Locomotive, Steam and Electric Cranes, Belt Conveyors, Industrial Railways, and Cars, Orange Peel Buckets, Clam Shell Buckets, Feed Water Heaters, Concrete Mixers, etc.

Ottumwa Iron Works, Ottumwa, Iowa Steam and Electric Hoists and Mine Equipment

Erie Engine Works, Erie, Pa. Steam Engines, Boilers and Portable Outfits.

Union Iron Works, Erie, Pa. Water Tube Boilers and all other types.

Hill-Tripp Pump Company, Anderson, Indiana Centrifugal Pumps and Large Capacity Deep Well Pumps.

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HEAD OFFICE: 12 King Street East, TORONTO

BRANCH OFFICES: Vancouver, Sudbury, Montreal, Halifax, and in the King Edward Hotel, Toronto

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

Continued from page 70,

Dimension Timber—No. 1 pine, spruce, tamarac [illegible] 8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38, 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39, 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40, 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $4[illegible].

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 85 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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"TAMCO" Crushed Stone in all sizes, for all purposes.
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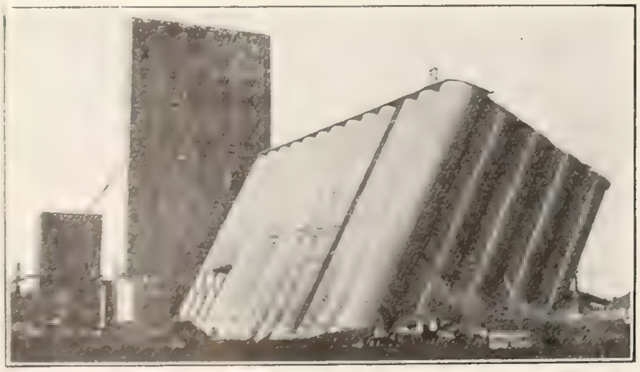

NOTICE

The building in the illustration, built of concrete, was righted to its proper position without damage to structure.

MARSH and HENTHORN HOISTING MACHINERY

was used on the entire contract.

Strongly Built **Easy to Operate** **Complete Control**

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Prompt shipments from Factory or nearest warehouse.

THE AUTOMATIC BALL BEARING ELECTRIC FLOOR SURFACING MACHINE

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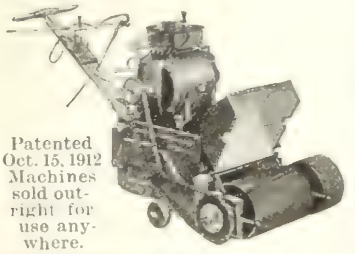

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Genuine "Sirocco" Patented

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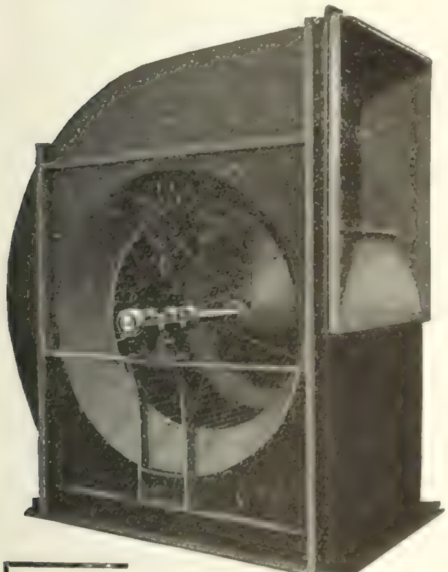

Single Inlet, Top Horizontal Discharge Sirocco Fans Built in sizes with capacities of 75 C.F.M. to 1,000,000 C.F.M. in all angles of discharge and arranged for either pulley, motor, engine or turbine drive.

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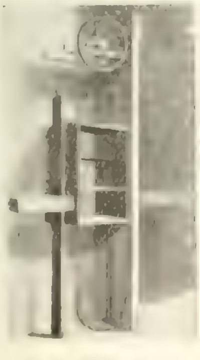

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50 to 150 lbs. capacity

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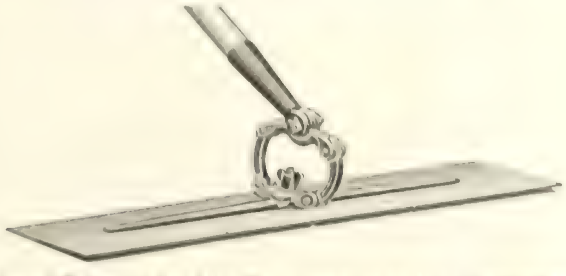

"Abram" Sidewalk Finishing Tools are sold on the Guarantee that **ONE MAN** can do more work with them than **THREE MEN** can do with ordinary tools. This means: If finishers get $4.00 per day, you save the wages of **TWO MEN**, or $8.00 per day, by using **"Abram"** Tools. We positively guarantee this result. Let us prove it to you. Circular.

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"A Right Material—A Perfect Brick"

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Everlasting Concrete Brick

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Architects—Viau & Venne, Montreal.

This building is faced on all sides with grey concrete brick, trimmed with red.

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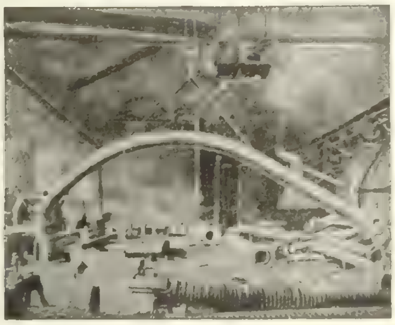

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eliminate heavy fittings
economize space,
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We make pipe bends in size and shape to meet your specifications. The cut above illustrates a 20 inch expansion bend of 16 foot radius containing 38 feet of pipe joined in the arc by the Atwood Line Weld.

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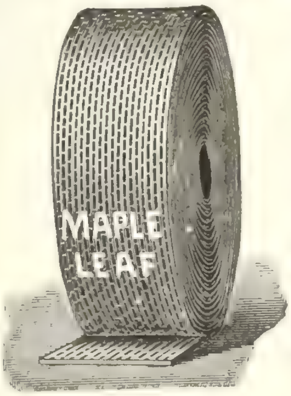
Looking for the "Maple Leaf"

Has Become a Habit with Superintendents and Engineers.

The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



"Maple Leaf" Brand Stitched Cotton Duck Belting.

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

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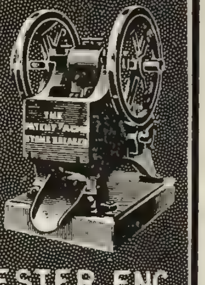
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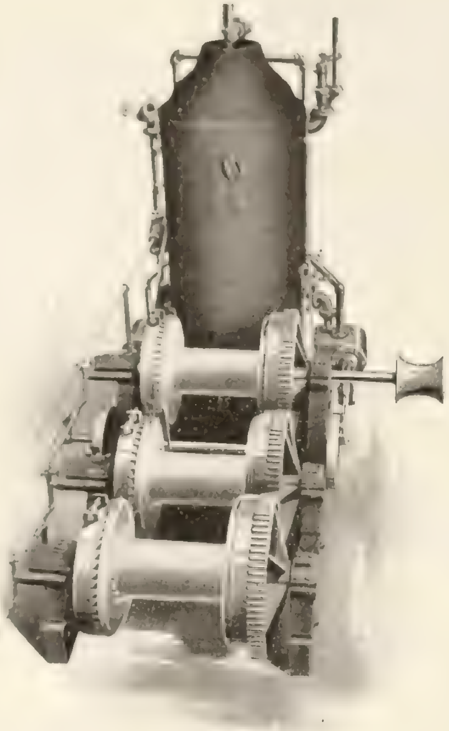

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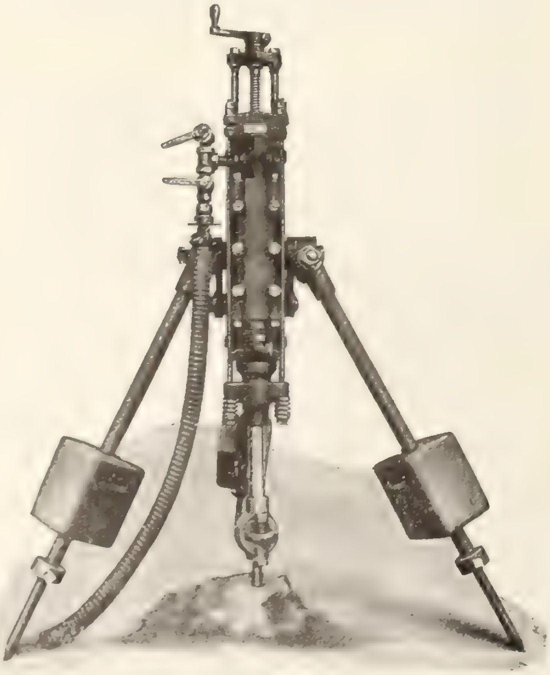

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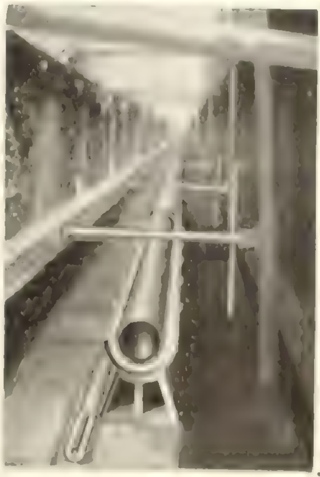

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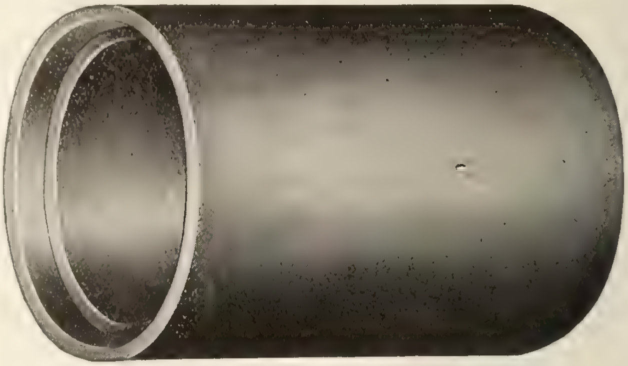

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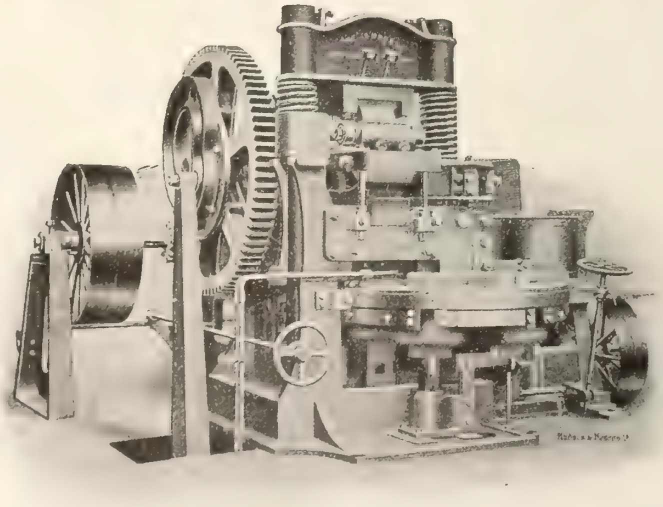

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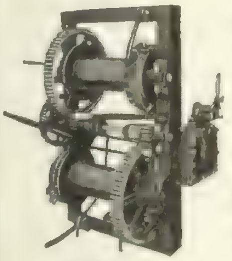
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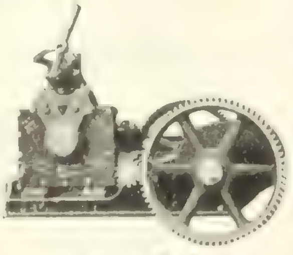
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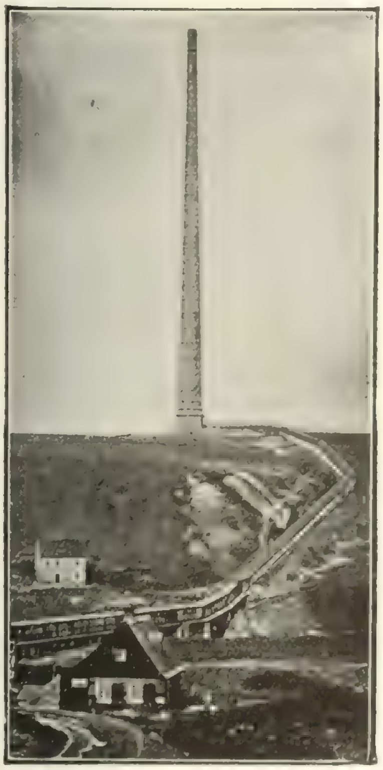

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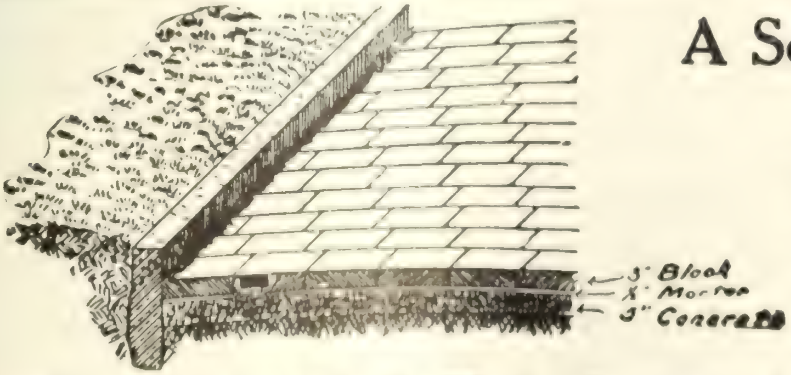

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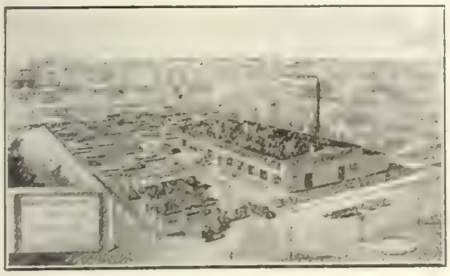
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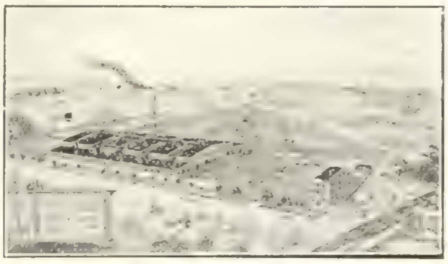
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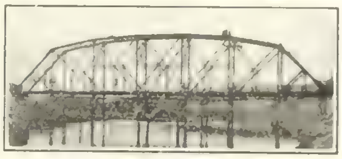
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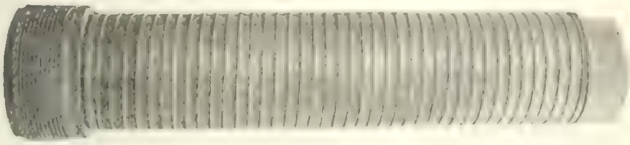

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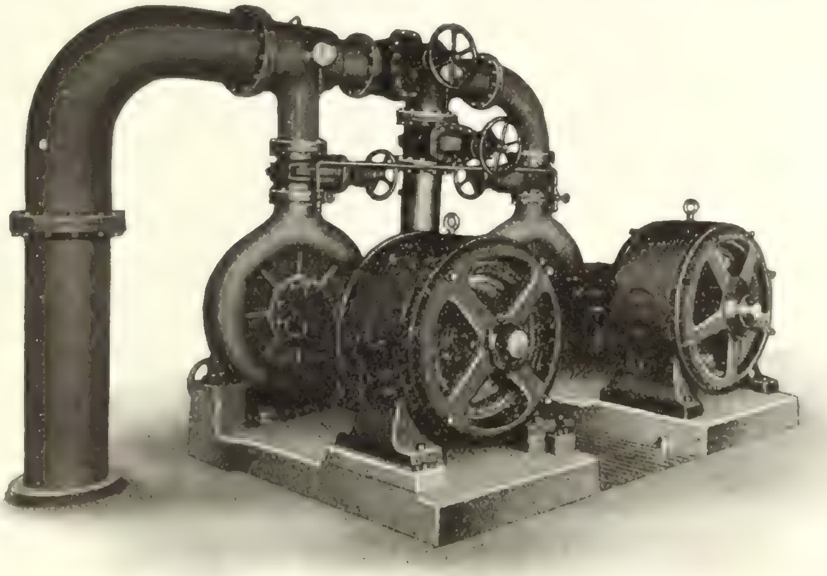

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Pavements, Roads, Waterproofings, Floors, Sidewalks, Tars, Asphalts, Bitumens, Oils, Paints, Bituminous Specialties.

A new plan for Efficient Road and Paving Inspection

378 Woodward Ave., DETROIT, MICH.

H. J. Griswold B. W. Seton

Dominion Engineering & Inspection Co.

Inspecting and Consulting Engineers

Head Office and Laboratories
318 Lagauchetiere St. West,
MONTREAL

Toronto Branch, 73 Adelaide St. West

Cement Testing and Reinforced Concrete Inspection.

Mill, Shop and Field Inspection of Steel Structures and Bridges.

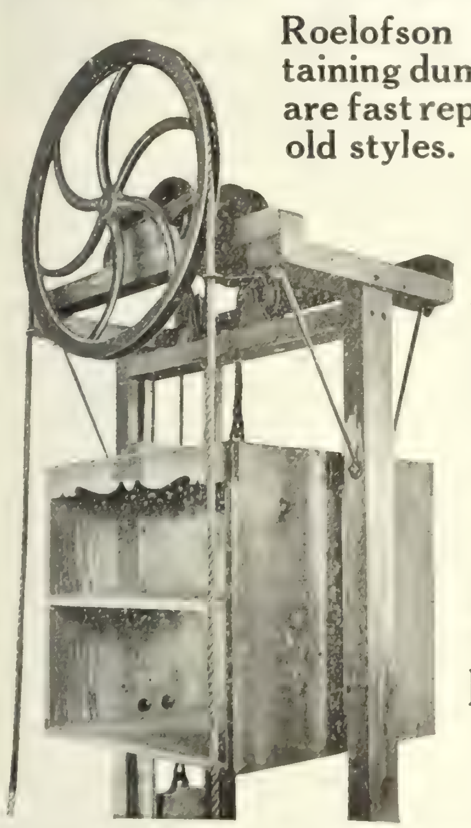
Tests and Inspection of Iron and Steel Pipe etc.

Expert Examinations & Reports.

Represented at New York, Pittsburgh, and Chicago; Glasgow, London, Liege and Essen.

DUMB WAITERS

Roelofson self retaining dumb waiters are fast replacing the old styles.

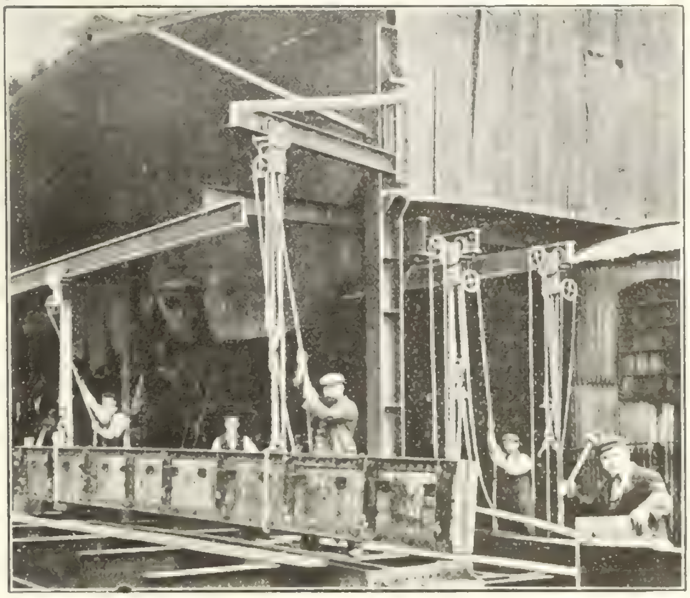


They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson
Elevator
Works
Galt, Ont.

HAVE YOU A GOOD SYSTEM OF LIFTING AND SHIFTING?
TRY A MORRIS TRAVELLING BLOCK.



THE HERBERT MORRIS CRANE & HOIST COMPANY, LIMITED.
EMPRESS WORKS PETER STREET TORONTO

DENNISTEEL
UNIT-CONSTRUCTION

LOCKERS AND SHELVING

For

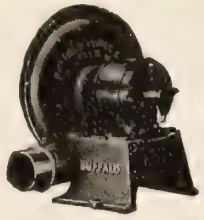
Jigs Tools Small Parts

Here's a locker that's ideal for keeping these articles. Affords protection and encourages system. Made of sheet steel in standard sizes or special sizes for any requirement. Has three-way locking device and is solidly constructed. Built on a unit system with any arrangement of compartments and shelves, which can be readily adjusted or changed about. Japan or enamel finish. Costs little, if any, more than wood and is vastly superior.

There isn't a style of Locker, Cabinet, Bin or Shelving we don't make in the modern steel equipment. Secure, Sanitary, Efficient and Cheap. Isn't it worth your while to investigate?

THE DENNIS WIRE AND IRON
WORKS CO. LIMITED
LONDON
CANADA

No. 228
Size:-32 x 44 inches.



No. 681-E Size:-38 x 42 inches
"Swing-Over" Hood for auto
repair work.

"Buffalo"

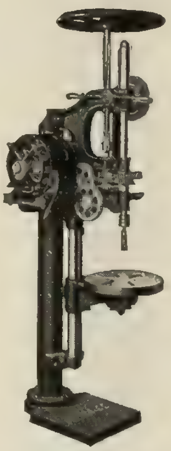
FORGES, BLOWERS, DRILLS

The Standard by which others are judged.

All "Buffalo" Tools combine strength, capacity, small floor space requirements, low power consumption and flexibility to the greatest possible extent. "Buffalo" design and construction are leaders to-day and have been since the inception of the business. Each tool is the best for its particular service. Electrically operated blowers, drills and forges. All sizes for all classes of work. The only efficient variable speed electric motor on the market. Do your work the modern way. Electricity costs less and always responds.

Our catalog No. 179-12 covers the complete line. Every machine is illustrated and described in detail. If you can use a copy write for it.

No. 200-P
Hand Blower
Sizes:-12-14-16
inches.



No. 124-CE Capacity,
1½ inch holes with ½
H. P. motor. Gear
guard furnished.

Canadian Buffalo Forge Company, Limited
St. John, Montreal, Toronto, BERLIN, Winnipeg, Vancouver

Do You Use Renfrew Lime?

If you don't, you are missing an opportunity of saving 75 cents a day on each bricklayer, and of laying 200 more bricks a day.

'Renfrew' Lime requires less time for tempering. Does not set so rapidly and allows the bricklayer to spread far more bricks.

'RENFREW' the Lime of QUALITY

White and Gray Lime—Stone—Brick Drain Tile

Jamieson Lime Company

Renfrew, Ontario

From generator to consumer you should install reliable

Northern Electric Wires and Cables

In the largest wire plant in Canada—under the Northern Electric trade mark and guarantee is manufactured *every type* of wire and cable, including

High Tension, Lead Covered Paper Insulated, Power Cables

Northern Electric Wires and Cables are the most carefully made—the most rigidly tested—the most universally satisfactory transmission in use to-day. From raw material to finished product the skilled workmanship of our operatives is ***continuously*** supervised and inspected. Electrical engineers whose reputations have been made on exacting work of great magnitude, use Northern Electric Wires and Cables.

One order recently received from the Montreal Light, Heat and Power Company and another from the Cedars Rapids Manufacturing & Power Company together constitutes the largest single order ever placed for lead covered high tension power cable. The first mentioned concern has more underground cable installed than any other public service corporation — and its Engineers ***know*** Northern Electric dependability from comparative tests ***in service.***

The Northern Electric line includes:

**Cable Terminals,
Compounds, Junction
Boxes and other accessories**

Write for data on any wire or cable problems that confront you.

Northern Electric Company
LIMITED

MOMTREAL HALIFAX TORONTO
WINNIPEG REGINA CALGARY
EDMONTON VANCOUVER VICTORIA

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

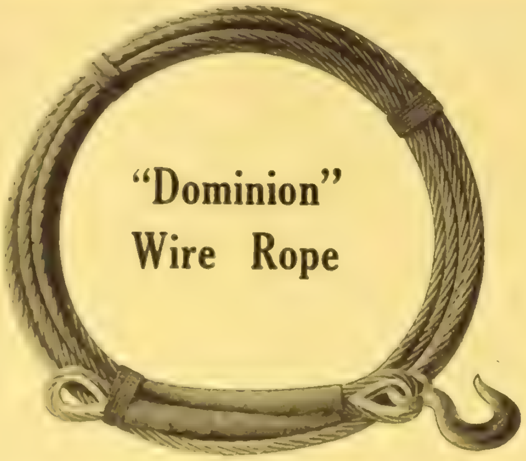
This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West. Toronto
Phone Adelaide 2700



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths wire rope for **Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.**

We manufacture special ropes to take care of your particular needs.

Wire Rope Fittings, Blocks, Clips, Etc., in stock

THE DOMINION WIRE ROPE CO., Ltd.
MONTREAL

"Industrial Works"

Locomotive-Coaling and Wrecking

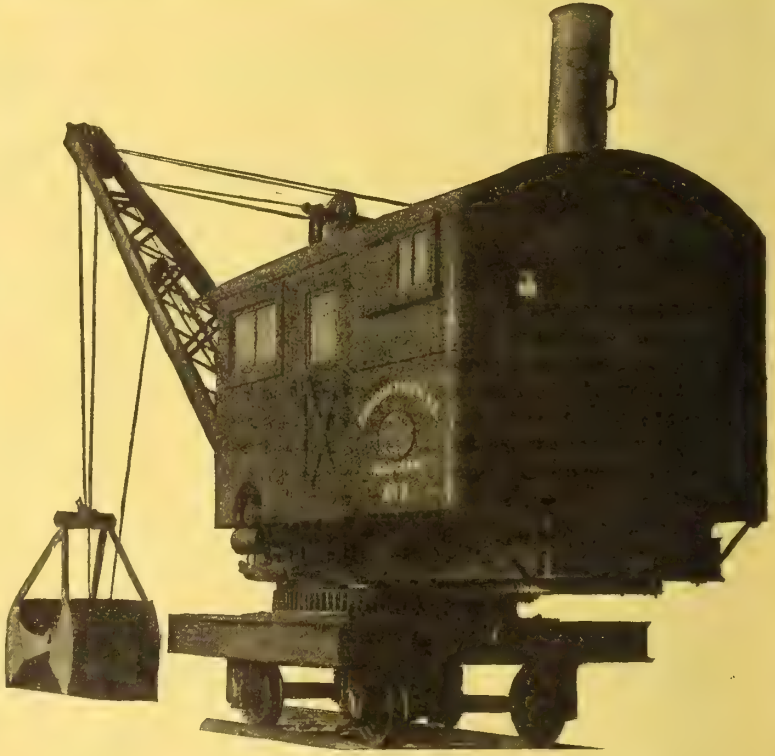
CRANES

In capacities from
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request.

We supply Contractors' Equipment of all descriptions.

F. H. HOPKINS & CO., HEAD OFFICE **MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, October 21, 1914 No. 42

ESTABLISHED 1886

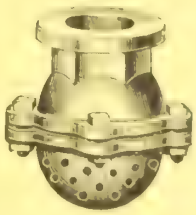
Contract Record and Engineering Review

Smart-
Turner
Pumps

All Classes of Steam and Power Pumping
Machinery, Travelling Cranes, Foot
Valves, Etc., Etc.

Estimates furnished on equipment to suit any requirements.

Our Motto: *Satisfaction to Every Customer.*



The Smart-Turner Machine Co., Ltd.
Hamilton, Canada

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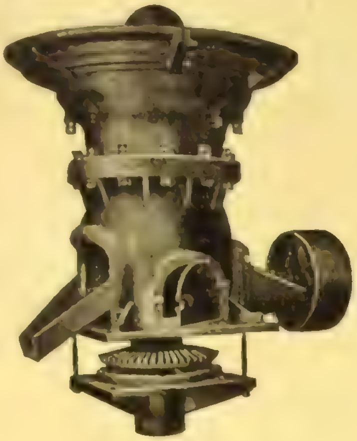


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

Sheaves In Hard-to-get-at Places Should be Equipped with

"American" Self Lubricating Bushings

THESE bushings are cast from a carefully balanced combination of metals, which years of experience and experiment have taught us is best suited for the purpose. They are filled with a special lubricating compound which lasts as long as the bushing itself and keeps the sheave running smoothly and easily without the slightest attention.

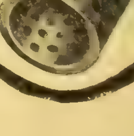
Made by

American Hoist & Derrick Co.

ST. PAUL, MINN.

Sold by

General Supply Co. of Canada, Limited, Montreal, Ottawa, Toronto.
Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Limited, Vancouver, B. C.
Gorman, Clancy & Grindley, Edmonton and Calgary, Alta.



28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

"Business As Usual"

We have not, owing to the war, shut down any of our plants, discharged any of our workmen, reduced their hours of labor or cut their rate of pay.

We are doing "BUSINESS AS USUAL."

We intend to continue this policy to the extent of our ability, and, to that end, suggest that you confine your purchases, during the war and thereafter as largely as possible to goods "MADE IN CANADA."

When in the market for Rubber goods of any description—Belting, Hose, Packing, Tires or anything else—write or wire our nearest Branch for prices and information.

It is our desire to serve you.

"Business As Usual"

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

28 "Service" Branches
Throughout Canada

37,100 Cubic Yards

OF ROCK MOVED IN 30 DAYS
AT A DRILLING COST OF

64 Cents Per 100 Yards

This is an actual record made by a Cyclone Blast Hole Drill working in hard Sandstone and Shale. The Cyclone No. 14 Blast Hole Drill, manufactured by the Cyclone Drill Co. of Orrville, Ohio, is designed expressly for Blast Hole Drilling.

Four of 18 Cyclone Drills owned by Holbrook, Cabott & Rollins, R. R. Contractors.

We claim the No. 14 will drill more hole at less cost than any other blast hole drill on the market.

We will back this claim by putting a machine on your work on trial against any other blast hole drills you may designate for a period of from 30 to 60 days.

IF YOU CAN USE BIG BLAST HOLE DRILLS WRITE US FOR PARTICULARS.

Sole Canadian Sales Agents

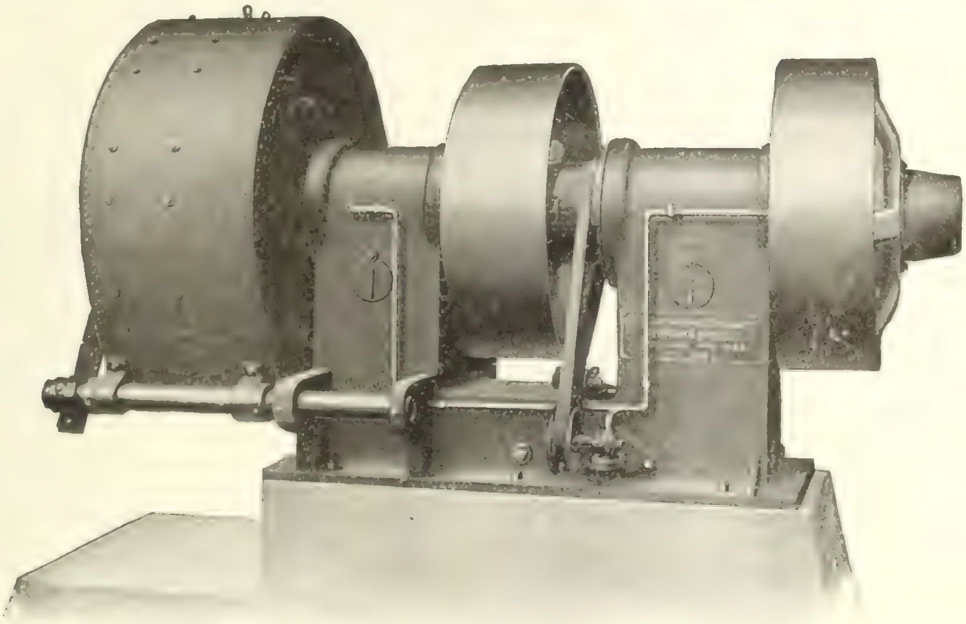
Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

CAPACITY - DURABILITY

are the Main Features in the

Symons Disc Crusher



40 tons of quarter inch to 1,000 tons of two and a half inch stone per day.

Gives the greatest amount of service for the least initial cost and expense of maintenance.

One owner says "It is efficient in operation, economical in repairs and perfectly satisfactory in every respect."

CARRIED IN STOCK

Mussens Limited

MONTREAL 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

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The following regulations apply to all advertisers: Eighth page, two headings; quarter page, four headings; half page, eight headings; full page, sixteen headings.

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Hull Iron & Steel Foundries

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Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

Architects
Weeks, Arthur L.

Architects' Instruments
Stanley Co., W. F.

Architectural Iron Work
Aikenhead Architectural Iron Works
Canadian Allis-Chalmers, Limited
Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works
McGregor & McIntyre
Meadows Co., Geo. B.
Steel & Radiation Ltd

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Feather & Roadhouse

Architectural Terra Cotta
Northwestern Terra-Cotta Co.
Toronto Plate Glass Imp't'g Co.

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Gillis & Geoghegan

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Aztec Oil Asphalt Company
Asphalt & Supply Co.

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Dominion Belting Co.
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Armstrong Manufacturing Co.

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Canadian Sirocco Co.
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Boving Company of Canada
Inglis Company, John
Jenckes Machine Co.
Leonard & Sons, E.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Mussens Limited
Rock & Power Machinery

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Standard Underground Cable Co. of Canada Limited

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National Builders' Supply & Enamel Concrete Brick Co.
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Wadsworth Howland Co.

Brick Dryers
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Canadian Sirocco Co.
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Sheldons Limited

Brick Machinery and Supplies
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DesMoines Bridge & Iron Co.
Dickson Bridge Works
Dominion Bridge Co.
Hamilton Bridge Works Co.
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Manitoba Bridge & Iron Works
Maritime Bridge Company
National Bridge Company
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Browning Company
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Manitoba Bridge & Iron Works
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Sudbury Construction & Machinery Co.
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Northern Electric Co.
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Smyth & Ryan

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Cement Gun Company

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Woodhouse Chain Works

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Laurie Company, E.

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Manitoba Bridge & Iron Works

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Beatty & Sons, M.
Browning Company
Brown Hoisting Machinery Co.

Concrete Form Clamps
Railway Contractors Supply Co.

Concrete Mixers and Appliances
Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
Jaeger Machine Company
Lecky & Collis
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Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
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Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

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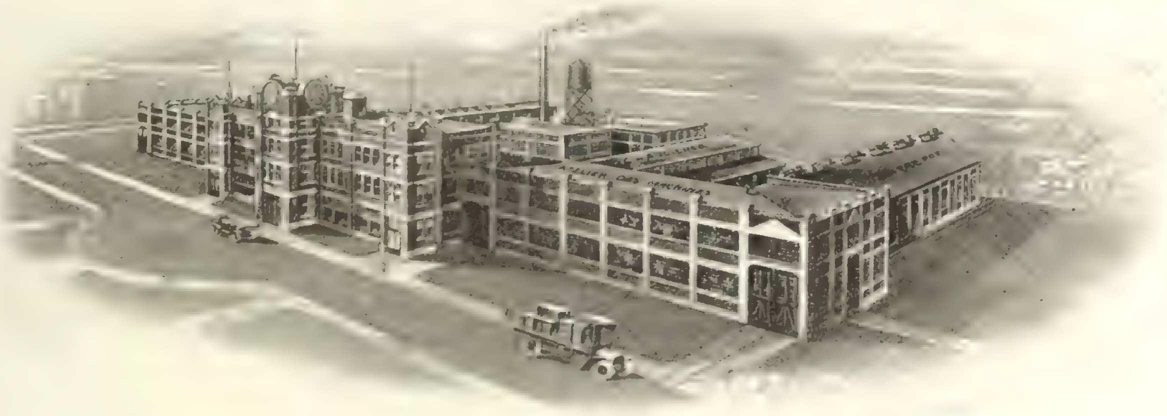


Head Office and Works

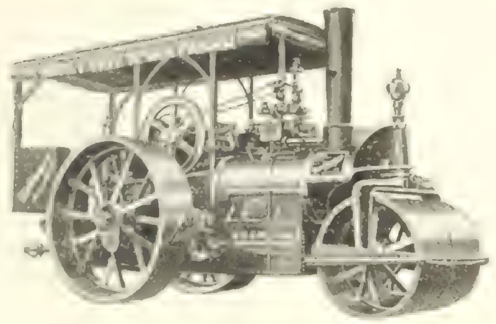
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



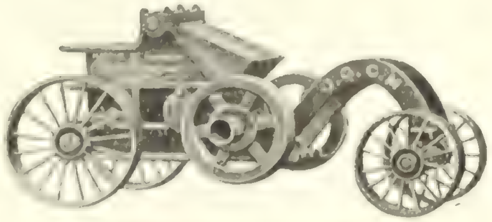
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

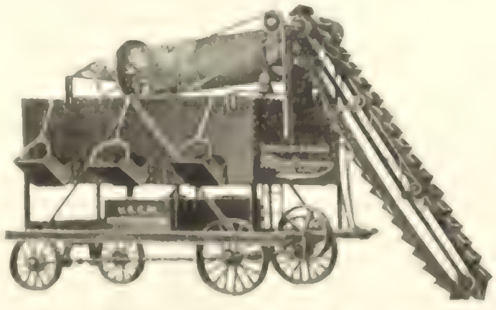
A great feature
"Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

Replaced by

Sturtevant

(REG. CAN. PAT. OFF.)

Mechanical Draft

THIS photograph is not an accident. It is merely an incident in the new order of things. For years this chimney supplied the draft for a large Illinois plant but gave way to a better system.

Mechanical draft has very many decided advantages over nautral draft. Here they are :-

More Steam from your boilers.
Sudden demands for power easily met.
Steam Pressures can be kept absolutely constant.
In connection with mechanical stokers they tremendously increase boiler capacity—more than 200% rated capacity is often obtained.
More draft and just when you want it.
Decreases Smoke.
Peak loads handled with ease.
Independent of weather conditions.
Can be used where building restrictions forbid high stacks.
Cheaper Fuel can be used.
Sawdust, screenings and mill waste can be burnt.

There are hundreds and hundreds of Successful Sturtevant Forced and Induced Draft Systems all over the world. Each one is designed for the special needs of the plant.

If you have insufficient draft or insufficient steam, talk with our engineers. A request for information puts you under no obligation. Catalog 1101 describes our system.

B. F. Sturtevant Co. of Canada
Limited
GALT, ONTARIO

Montreal Toronto Winnipeg Vancouver

CERESIT WATERPROOFING CO.

Gentlemen:—In reply to yours of the 18th inst. will say that we have used CERESIT Waterproofing in the foundations of a large warehouse and in the erection of a Power Plant. In both cases the CERESIT was used in the mass of concrete and we have found it to give perfect satisfaction. Yours very truly,

R. F. WILSON & CO.
Per R. F. Wilson

PERFECT SATISFACTION

CERESIT
TRADE MARK

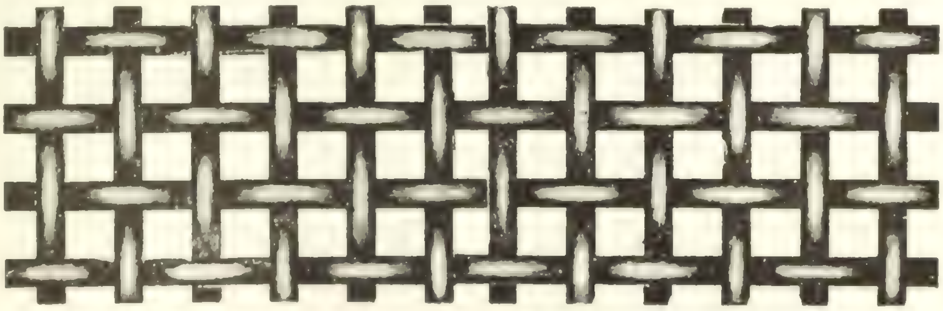
Ceresit gives perfect satisfaction wherever used. It has given hundreds of other contractors perfect satisfaction—and can do the same for you. Try it. Write for the 1914 "Book of Evidence" which tells the complete story.

"MADE IN AMERICA"

CERESIT WATERPROOFING CO.

913 Westminster Bldg., CHICAGO
FACTORIES—Chicago, London, Paris, Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. deB. Carrite, St. John, N.B.; W. K. Macdonald Co., Toronto, Ont.; McLelland Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd, Saskatoon, Sask.; N. G. DeHaas. Sault St. Marie, Ont.



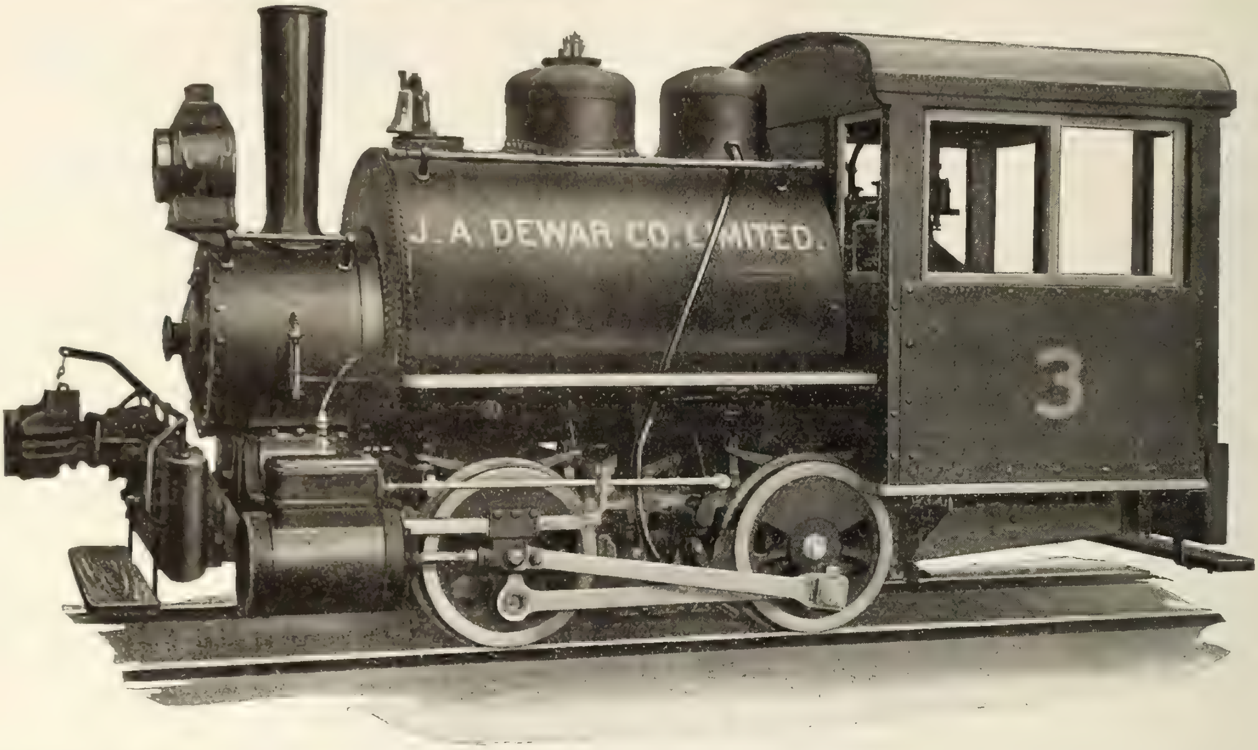
GREENING'S

WIRE CLOTH - WIRE SCREENING

All grades of Wire Cloth, Double Crimped.
Screening Accuracy Guaranteed.
Made of Steel—Copper or Brass
Galvanized and Tinned Cloth
Perforated Metals Wire Rope

The B. Greening Wire Co., Limited.
Hamilton, Ont. - Montreal, Que.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

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Steel Collapsible Gates

We make a specialty of all types of Collapsible Gates for Main Entrances, Store Fronts, Elevator Openings, etc.

ILLUSTRATIONS AND PRICES GLADLY GIVEN

Aikenhead Architectural Metal Works

364-370 Richmond Street W., Toronto, Ont.

One man lifting 1800 lb. casting.

SPEAKS FOR ITSELF

to the contractor who wants to save on his pay roll.

The

LAURENT-CHERRY CAPSTAN PULLEY BLOCK

Slack taken up on winding drum.

Just like a Hoisting Engine.

Three Sizes

No. 2 Block, ¼ or ⅜-in. Rope, Weight 3 lbs., Capacity ¼-ton	5.50
No. 4 Block, ½-in Rope, Weight 14-lbs., Capacity ¾-ton	11.10
No. 6 Block, ⅝ or ¾-in. Rope, Weight 27 lbs., Capacity 2 tons	17.00

All prices f.o.b. Toronto

MILLS BROTHERS

Sole Canadian Agents and Distributors

215 Ryrie Bldg. **Toronto, Canada**

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of teriffic usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessenned after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

Have Your Building Daylighted

WHILE it is not possible to have every part of every building daylight it is practical to have some portions of most buildings daylighted. The one best way to accomplish results in daylighting is by the use of

LUXFER PRISMS

These are made up of a number of accurately formed prismatic angles that are capable of refracting daylight and putting it where it is wanted.

Always specify the first and best prism Luxfer.

Luxfer Prism Company, Limited

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  Canadian Billings & Spencer, Ltd.

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  Schell Foundry & Machine Co.
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Electric Air Rock Drills
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Electric Steel Castings
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  Canadian Buffalo Forge Co.
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  Chipman & Power.
  Dominion Engineering & Inspection Company
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  Galt Engineering Co., John
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Exhaust Heads
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  Sheldons Limited

Expanded Metal
  Pedlar People Limited

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  Canadian Sirocco Company
  Sheldons Limited
  Sturtevant Co. of Can., Ltd., B. F.

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  Can. Consolidated Rubber Co.

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  Hope & Sons, Henry
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Forgings
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  Armstrong Mfg. Co.
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Gasoline Engines
  Armstrong Mfg. Co.
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  American Hoist & Derrick Co.
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  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock and Power Machinery
  Royce Limited

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G & G TELESCOPIC HOIST (PATENTED)

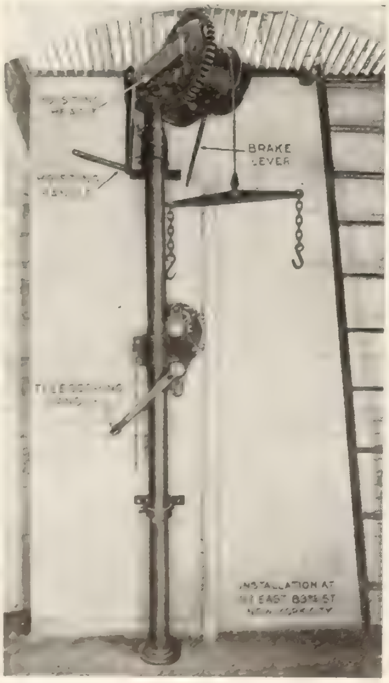
With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan
549 West Broadway
New York



Compact—easy to erect. Takes up no room in basement.

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Black Building Supply Co., Ltd.
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Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

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Winnipeg

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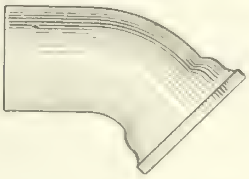
Warren Pipe



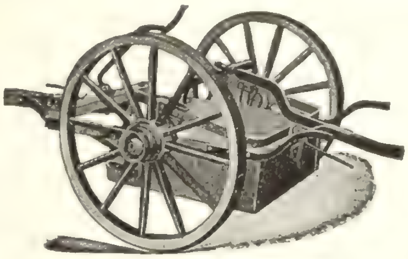
Ask us to quote on your next order—any size, 3" to 60" diameter, bell and spigot or flange—also special fittings and castings of all kinds.

For fifty-eight years we have manufactured the best quality of cast iron pipe.

Information and prices on request.

Warren Foundry and Machine Co.
11 Broadway - NEW YORK

The Passing of the Shovel
in earth work. It is practically supplanted by
Western Wheeled Scrapers



Fewer men required. More work done in less time. Western Wheeled Scrapers are the original. None of the imitations are built so strong, have the many improvements, or are as durable and efficient.

Catalog gladly sent upon request.

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
AURORA, ILLINOIS
Dominion Equipment & Supply Co., Winnipeg, Calgary, Edmonton
Agents for Manitoba, Saskatchewan, and Alberta
Canadian Equipment Co., Montreal, Agents for Eastern Canada

Macadam Roads

must be built of a
Tough Stone
that will cement
WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Excelsior Plate Glass Co.
Pilkington Bros.

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Sarnia - Keystone Copper Bearing Galvanized

Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron
Plain Black Iron
Galvanized Iron

V-Crimped Roofing
Metal Siding
Valleys

Conductor Pipe
Eave Troughs
Culverts

Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

Sarnia Metal Products Company, Limited
Sarnia, Canada

One Municipality Saved $92,000

By advertising their tenders in the " Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

347 Adelaide Street West, Toronto

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Canadian Sirocco Co.
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Pittsburgh-DesMoines Steel Co.
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McDougall Caledonian Iron Wks.
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Steel Barrels
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Steel Boxes
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McDougall Caledonian Iron Wks.
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Piggott & Co., Thos.
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Vancouver Wood Pipe & Tank Company
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Gillis & Geoghegan

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Pittsburgh Valve, Foundry & Construction Company

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Standard Underground Cable Co. of Canada, Ltd.

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Greening Wire Co., B.

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Canadian Billings & Spencer, Ltd.

Barrett Specification Roofs

For Large Business Buildings

THE Calgary Furniture Store, Limited, is built on modern lines. And like almost all first-class modern buildings, it is covered with a Barrett Specification Roof.

The general acceptance of The Barrett Specification among first-class engineers and architects is a highly significant development in the roofing trade. It is a movement which began with the leaders of the profession, who recognized its technical soundness. Accordingly, the inclusion of The Barrett Specification in full in building specifications is rapidly becoming a universal custom.

The Barrett Specification has the advantage of furnishing a uniform and fair basis for competitive bids, together with satisfactory methods for determining the quality of the workmanship and materials on the job. Our own experts are usually available to inspect the contractor's work and certify whether or not the Specification has been strictly complied with.

A Barrett Specification Roof will usually last twenty or more years without a cent's worth of repairs. It takes the base rate of insurance. It gives the most service per dollar, its unit cost being less than a quarter of a cent per foot per year of service.

Booklets on request.

THE PATERSON MFG. COMPANY, Limited

Montreal Toronto Winnipeg
Vancouver St. John, N.B.
Halifax, N.S. Sydney, N.S.

Architects: Brown & Vallance, Montreal. Roofers: D. R. Foulds, Ltd., Calgary. Contractors: Fysche, McNeill, Martin, Trainor, Ltd., Calgary.

Special Note

We advise incorporating in plans the [illegible] Barrett Specification, in order to avoid any misunderstanding.

[illegible]

ROOFING — Shall [illegible] directed in printed [illegible] 1911 [illegible] to the inspection re[illegible]

Calgary Furniture Store, Limited, Calgary, Alberta

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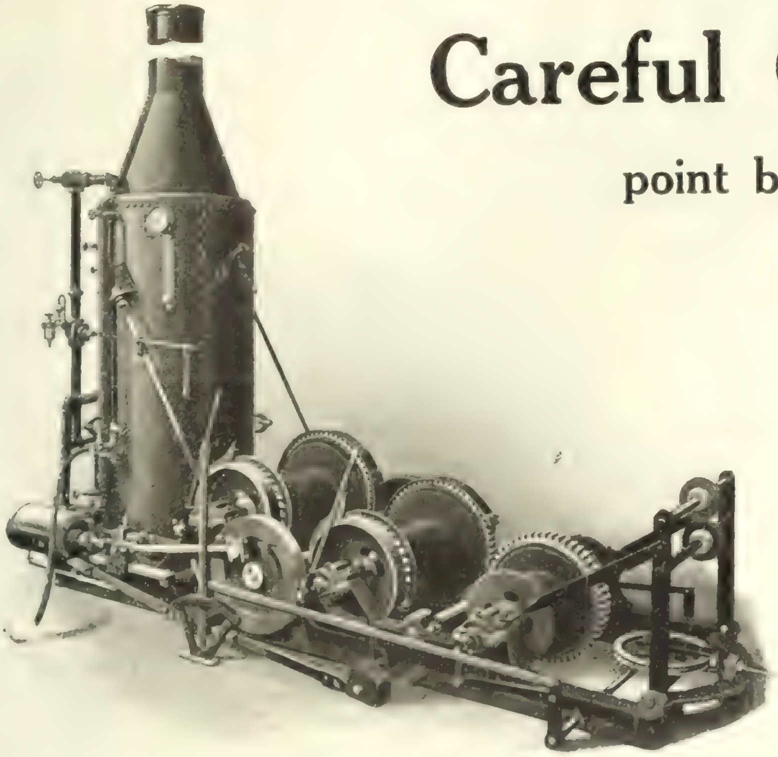

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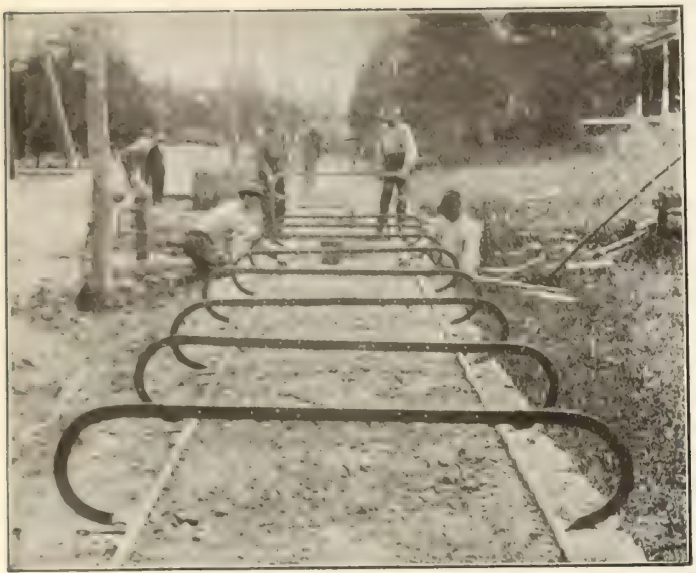

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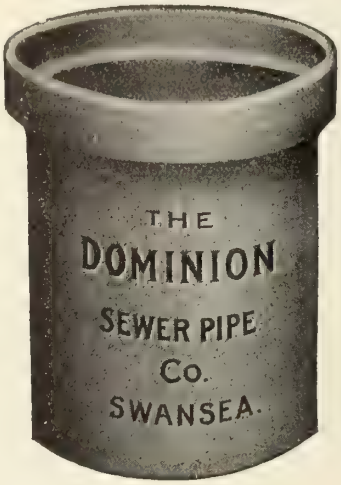

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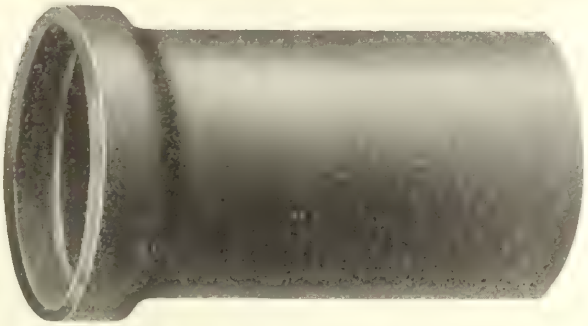

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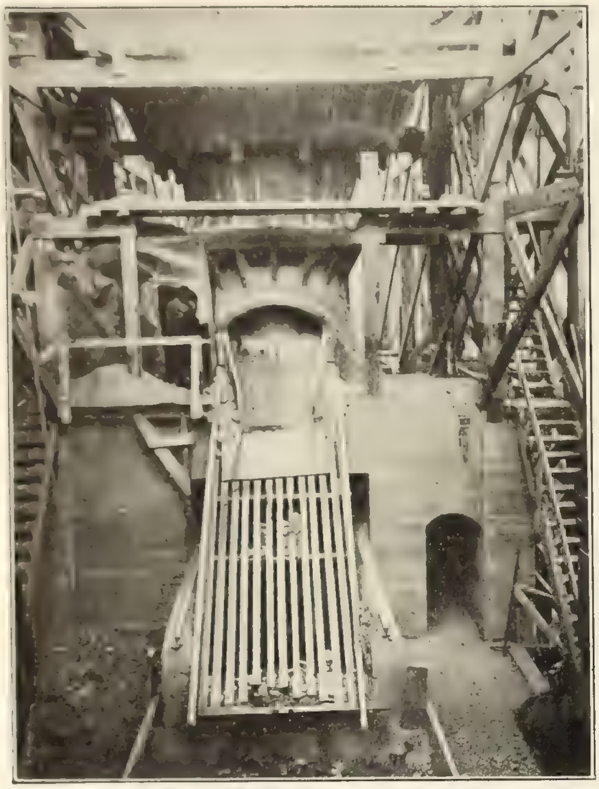

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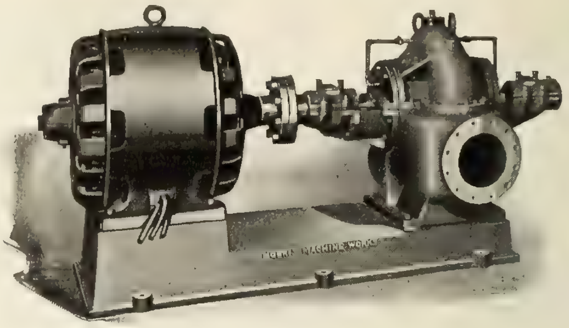

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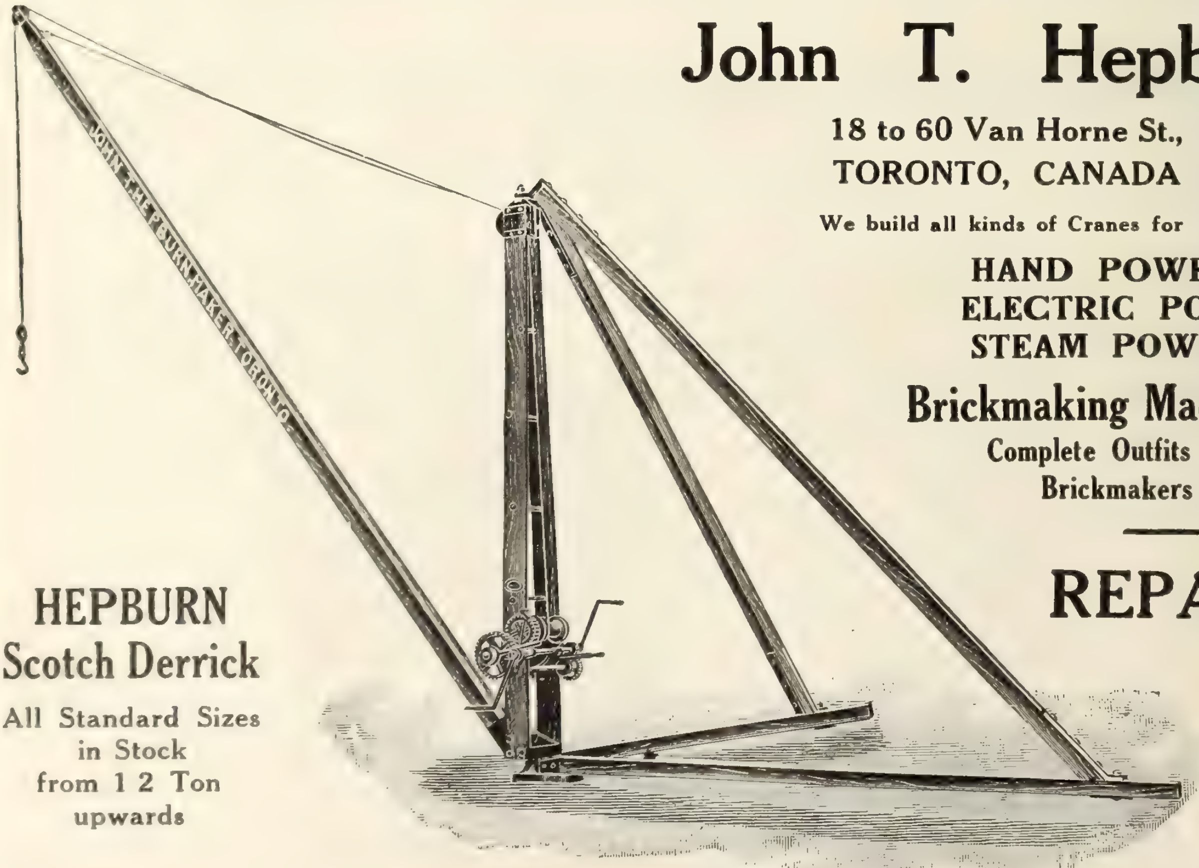
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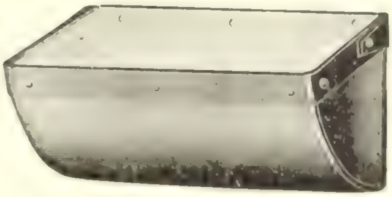

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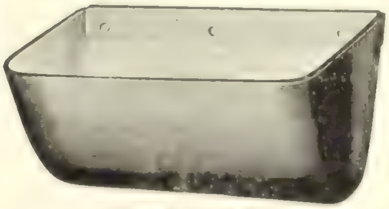

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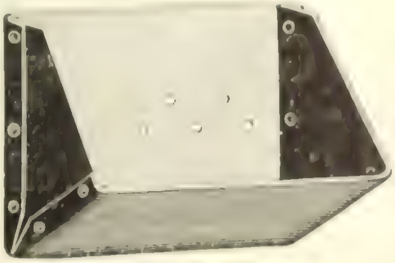

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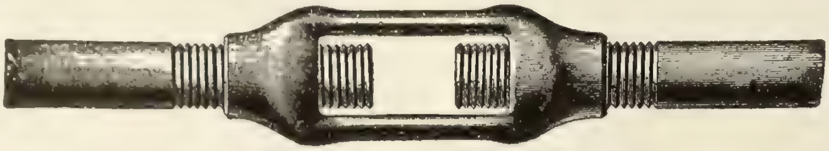

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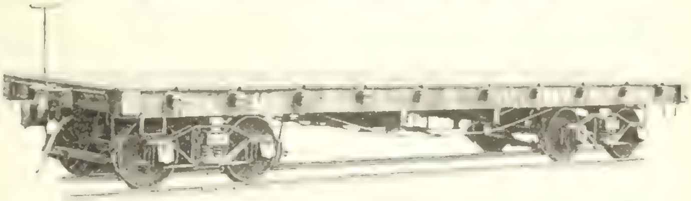

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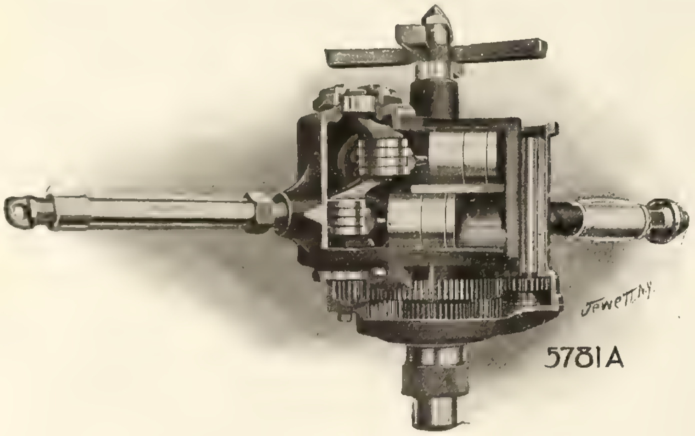

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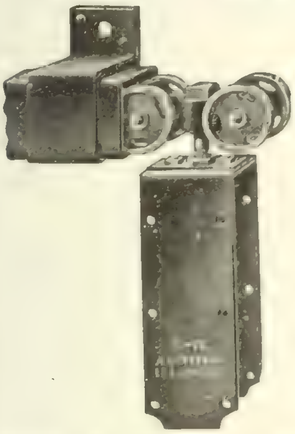

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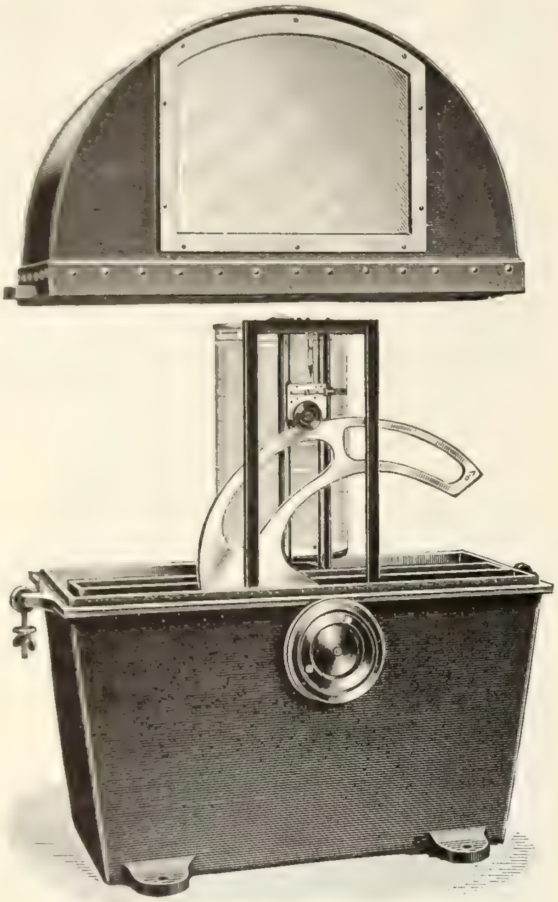

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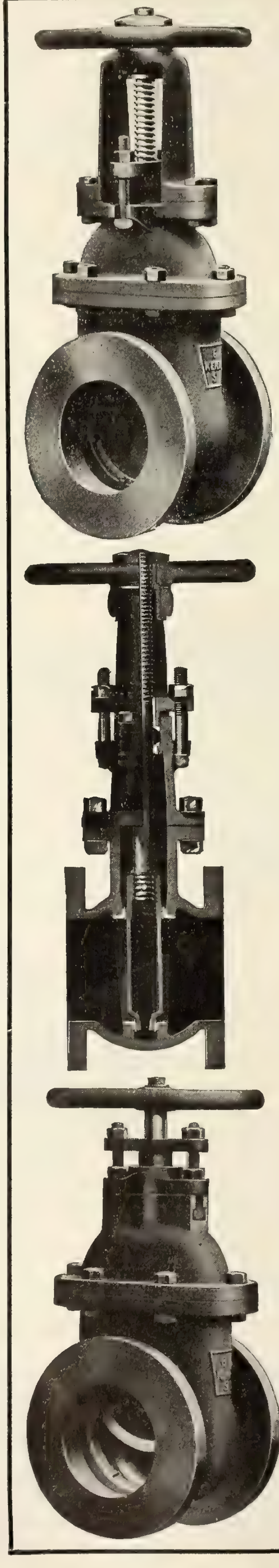

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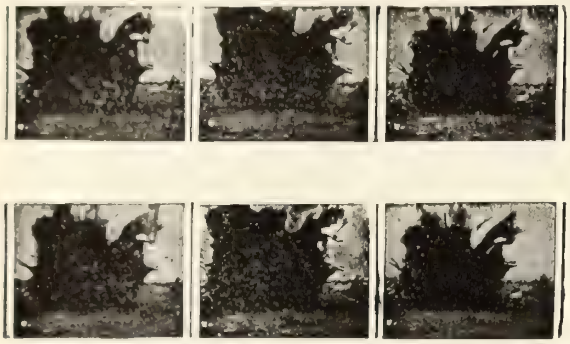

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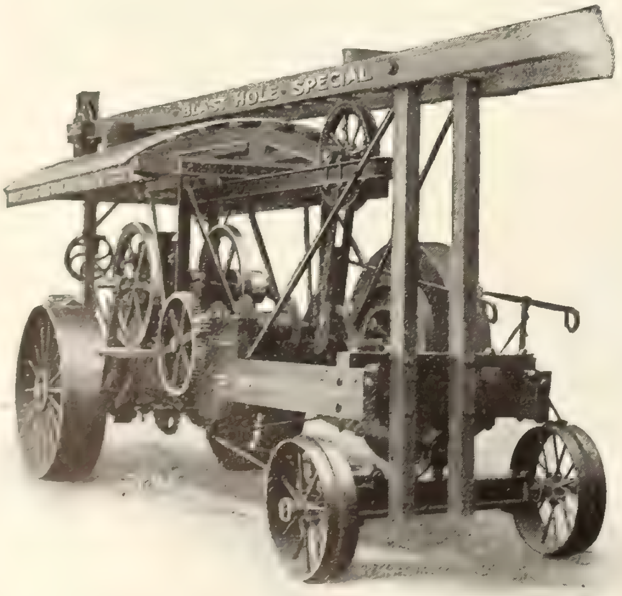

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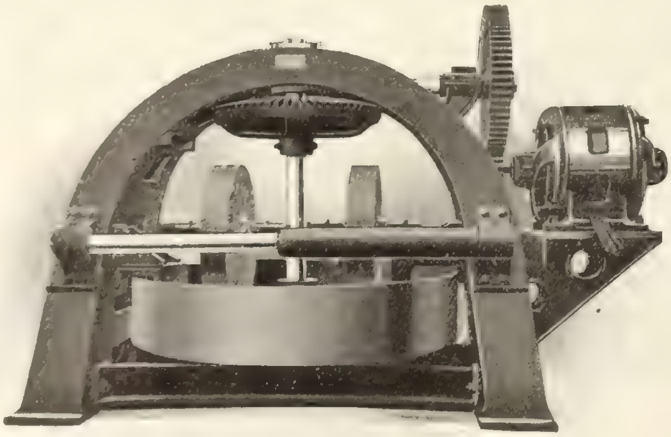

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The Exigencies of the Present

THE manner in which the exigencies of the present situation can best be met, having regard to the possibilities and prospects of the future, was considered editorially in our issue of September 23. Since the publication of that issue we have received many letters, varying in degrees of optimism and pessimism, dealing with the situation and outlook in the constructional world from the individual viewpoint.

The communication which shows the best balance is that from a large Western bridge building and structural steel firm, whose business was affected considerably by the restriction of building operations which followed the outbreak of hostilities in Europe. Our correspondent deals with three fundamental aspects of the situation, viz., (1) the attitude of the banks; (2) reduced cost of construction as an inducement to capital; and (3) the disposition of the labor organizations.

In regard to the first of these considerations, our correspondent finds common cause with us in deploring the criticism of the action of the banks. Such criticism, it is pointed out, is unavailing and tends to disturb business stability. Among the responsible constructional heads of Western Canada it is regarded as fortunate that the banks took the steps they did over a year ago in preparing every one for the conditions which have arisen since. If it were possible for the banks at this juncture to loan money freely on constructional enterprises it would not be long before much of it would be put to speculative uses, in which event the last condition would be more disastrous than the first. The banks have their own obligations and they have great responsibilities and it is only natural that they should set the example in putting into effect a temporary policy of conserving the country's financial resources.

Under no circumstances can a policy of aggressive business enterprise and liberal expenditure be justified during the present period. On the other hand, with such reasonable certainty of a successful issue there can be no defence of a self-sacrificing, short sighted policy of retrenchment. The one course is optimism gone mad and the other is business suicide.

Extremes are dangerous in every walk of life. It is the middle course which leads to success. The middle course in Canada to-day is holding what we have and keeping an eye on what we have not. Such a course involves close adherence to the principle of "business as usual," at the same time precluding the more or less speculative phases of business enterprise which are justified under normal conditions.

Our correspondent passes on to the second aspect of the case and expresses the view that unless capital can be convinced that the present reduction in cost is only temporary, constructional enterprises of all kinds will continue to be hampered and delayed. This, of course, has no application to public works in which the revenue is guaranteed by governments or municipalities. In regard to private enterprises throughout the country, one cannot urge too strongly upon engineering and contracting interests the advisability of presenting strong optimistic arguments relative to the temporarily reduced cost of construction brought about by the first and worst situation created by the war. In all conservatism it may be asserted safely that never again in our day and generation will there be such an opportunity for the man with money to make money as the present. The general principle of the argument, presented forcibly, and reinforced by local facts and local figures, cannot fail to exercise an influence in the right direction.

The third and final aspect with which our correspondent deals is the attitude of the labor organizations. In Western Canada—not alone in Western Canada, but in the west particularly—the recent attitude of the labor organizations has been most unfortunate, to say nothing of its being ill-advised on their own account. Contractors have been hampered by an obstinate policy on the part of the men's executives to hold out at all costs for the maintenance of the same wage scale which obtained before the war. Such a policy cannot but tend to destroy the influence of the organizations. If continued, it will lead to their disruption, for already there is in evidence an inclination on the part of various trades to throw off the restrictions laid upon them by the unions and to meet any reasonable proposition made by the employers. It is doubtful whether any concerted plan looking to the encouragement of construction work could be adopted as between contractor and employer, but when prospective business is in view it would seem that the contractor should take the matter up with the men individually or in small groups and make arrangements which will enable him to secure labor and prices at considerably lower rates than have prevailed during the last five years—rates at which under the present conditions of close figuring a fair profit is not possible.

In a measure the views expressed herein are a reflex of those which have been advanced from time to time in the editorial columns of this journal, but in the condensed form in which they are submitted and enlarged upon we believe they offer a policy of sound commonsense. In any case they are interesting as emanating from an aggressive Winnipeg company whose ramifications during the last few years have extended into every corner of Western Canada.

The New Hastings Street East Viaduct at Vancouver

THE grade crossings of the Great Northern Railway in the east end of Vancouver have always been a decided drawback to the development of that section of the city. About three years ago the question of providing overhead bridges on the streets affected became a live issue, with the result that plans and estimates for the construction of four viaducts were prepared in the City Engineer's office and submitted to the Railway Commission which in 1912 finally approved of the scheme and apportioned the cost to be paid by the parties interested therein, comprising the city, the B. C. Electric Railway Company, Limited, and the Great Northern Railway Company. It was proposed to erect bridges over Hastings, Pender, Keefer and Harris streets respectively, the "Mushroom" or flat slab type of reinforced concrete construction being eventually chosen for all four structures in preference to steel construction as was originally planned, a considerable saving being effected thereby. Following the consent of the Railway Commission the city engineer's department turned out designs for the "Mushroom" construction, these being later checked over and approved by Mr. C. A. P. Turner, the inventor of the system. The city then called for tenders and on March 9, 1914, awarded the contract to the Union Contracting Company at a price of $299,930 for the four bridges. A month later work was started on the bridge which carries that portion of Hastings Street East lying between Campbell Avenue and Glen Drive, over the Great Northern Railway tracks, this being the only structure proceeded with, the other three crossings being allowed to remain in their original state until such time as the money is available for their improvement. The length of the Hastings Street East viaduct is 616 feet between abutments and 99 feet wide—the total width of Hastings Street. Provision has been made for two 18 ft. 6 in. concrete sidewalks, the width of the road between curbs being 62 feet. Double street car tracks extend the entire length.

The street paving consists of 4-in. wood block on ½-in. 3 to 1 sand and cement cushion. The handrailing on both sides of the bridge consists for the most part of concrete posts and iron pipe, only a small portion, that over Glen Drive and the railway tracks, being of ornamental cast stone.

The contractors met with practically no difficulties when sinking the footings. It is true that in some places it was necessary to go down deeper than had been anticipated but this caused very little inconvenience.

Between Campbell Avenue and the west abutment of the bridge there is a fill varying in depth from zero up to 8 feet and retained by timber bulkheads on the north and south sides of the street. Wood block pavement and concrete sidewalks of similar width to that on the bridge have been laid on top of the fill. The thickness of the slab varies from 15 inches in the 25-foot spans to 22 inches in the 45-foot span over Raymur Avenue. A trench about 6 inches in depth and 18 feet 6 inches wide was allowed to remain in the centre of the slab until pouring had been completed and a reasonable time for setting allowed to elapse. The B. C. Electric Railway Company then proceeded to lay the street car tracks in the trench, the non-rigid type of track construction being installed owing to the comparative shallowness of the track allowance in this particular instance. The rails are 4¼ inches deep laid on fir ties 4½ inches deep x 8 inches x 8⅛ inches long, using screw spikes and ¼-inch steel tie plate. The tracks have been surfaced to the proper grade on 1-inch sand cushion laid beneath the ties, and the ties completely surrounded with concrete preparatory to paving with wood block. Rail joints of the continuous type were used in order not to interfere to any serious extent with the stresses in the bridge structure. Screw spikes were preferred in this case on account of the decreased depth of the ties. In order to protect the screw spikes and the tops of the ties from water seepage through the paving, the ties have been coated over with creosote oil and the spike holes given similar treatment.

The reinforcing of the structure is of the usual "Mushroom" type, the panels being reinforced longi-

Laying sidewalks and street railway tracks in west approach, Hastings Street viaduct.

Method of laying street railway tracks across the viaduct.

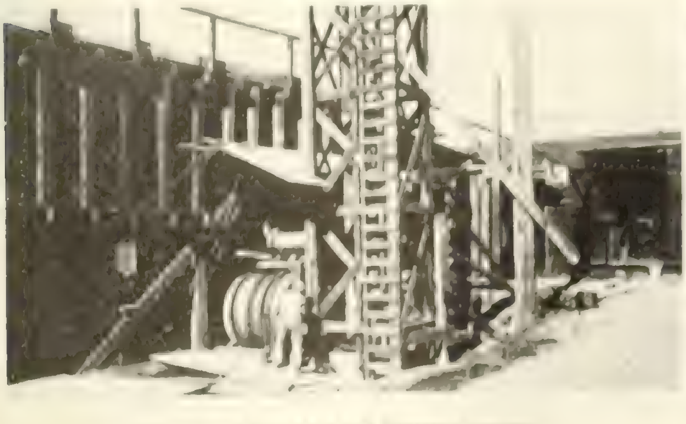
tudinally, transversely and diagonally by belts of rods varying in width from 12 feet to 15 feet according to the size of the spans. The columns are all octagonal in shape, 3 feet in diameter, and reinforced with six $1\frac{1}{8}$-inch steel rods with spiral hooping having a pitch of 3 inches. The "Mushroom" tops for the columns are of the usual design. Two expansion joints have been provided in the full length of the bridge, one at each abutment, the joints consisting of galvanized iron and sand. The slab was allowed to slide over a surface which is of galvanized iron, the surface of the slab angle being provide to cover the space left by expansion. The retaining walls are of the reinforced concrete counterfort type, the depth of these being 18 and 16 feet in the east and west abutments respectively. No piling was used in the viaduct for any of the footings, a sufficiently hard strata being reached at a reasonable depth below ground. The foundations for the columns comprised two concrete slabs reinforced four ways, the size of these varying, of course, with the size of the spans. The columns were all carried down to hard pan and the water was pumped out of each footing and prevented from encroaching during the time concrete was being poured. The footings were also kept perfectly dry when pouring was proceeding at the foot of the columns, thus ensuring perfect concrete at the bases.

The gravity system of pouring concrete was employed on this work. Bunkers were built on a vacant lot opposite the centre of the bridge and a teamway leading to the top of the bunkers was used by the contractors for delivering material. Underneath the bunkers a measuring chamber was erected into which the material was conveyed by gravity from the bunkers and then passed through to the mixer placed directly below. From there the concrete was loaded into the bucket and hoisted by means of an electric winch to the top of the tower, 210 feet from the ground, and dumped into the hopper. The operation of releasing the concrete from the hopper into the chute was controlled by a gate regulated by a workman on the hopper platform. Immediately after pouring had commenced it was discovered that a grade of at least 33 per cent. would be required on the chute to ensure free running concrete.

The contractors started pouring the slab on July 23 last and finished this section of the work on September 11, the average amount of slab poured every sixteen hours being 25 feet for the full width of the bridge.

The entire work has now been completed with the exception of the wood block paving which it is hoped to have fully laid by November 1.

Form faces on the track elevation work of the Chicago, Milwaukee & St. Paul Railway north of Wilson Avenue, in Chicago, are held together by cables made of eight strands of No. 10 wire prepared with a butterfly nut on each end in a special cable twister operated by two men. The butterfly nuts are threaded to receive short bolts passing through the forms. These nuts are made by the thousand in the shops of the railroad company. Occasionally six-strand cables break, but with eight strands no forms have given trouble. The cables are spaced on 3-ft. 4-in. centres vertically and on 4-ft. centres horizontally. Six 25-ft. cables are used to hold the bulkheads against the ends of the side form faces. The twister is composed of two 6 x 6-in. braced timber uprights, one of which is fixed and the other movable, mounted on a timber base, and fitted with a hand-operated crank.



Arrangement for mixing and delivering concrete

Bird's-eye view of the viaduct, looking east

Heavy Construction Work on the Grand Trunk Pacific Railway

WHILE the Grand Trunk Pacific Railway has secured a specially favorable location for the Rocky Mountain section of its transcontinental line as far as grades and a low summit elevation go, the construction of this part of the line has been attended with exceptional difficulties, says Engineering News editorially, referring to an article abstracted elsewhere in this issue. These difficulties arise from three causes: the severe winter climate, the topography and almost inaccessible character of the country, and the character of the streams which had to be utilized for transportation of material.

The necessity for expediting the progress of the work made it necessary to commence construction at various points, and this, in turn, made necessary the transportation of men, machinery and supplies to points not only difficult of access but often cut off entirely from any means of communication.

In ordinary railway construction it is usual practice to build temporary bridges in advance and thus to have a line of communication open with the base of supplies. But in the case of the Grand Trunk Pacific Railway there were many cases where temporary bridges could not be built or would be constantly liable to destruction, and it was desired to have the substructures for permanent bridges built in advance, so as to be ready for the steel superstructures when the tracklaying reached them. This necessitated establishing construction camps in distant mountain regions, where the means of communication were very limited and were liable to be interrupted entirely for considerable periods. Under such conditions ample supply of provisions, equipment and machinery parts was essential. Still more essential was the placing of the work in the hands of resourceful men who could turn emergencies into opportunities and could keep the work in progress whatever might happen.

Where the line follows the general course of the Fraser River, the river was adopted as a means of distributing material to the construction points, including the three long bridges which cross it. The river is navigable only at high-water period, which is during the summer, and is then too high and turbulent for construction work in the stream. The low-water period available for bridge construction occurs during the winter, which is very severe, the temperature continuing at 40 to 50 deg. below zero for considerable lengths of time. Under these conditions, much of the heavy material and supplies had to be taken to the sites in summer, by means of scows floating down a dangerous channel with a wild current and numerous rapids. In winter, with everything frozen solid, the coffer-dams were built, excavations made, and concrete deposited for the foundations and piers. But the work was planned to meet these conditions and was carried out successfully, while the concrete proved to be of excellent character, indicating once more that proper precaution and expense can make winter concreting quite practicable.

In winter there was communication by sled on the river, except when the snow was too deep, and this was the most favorable time to deliver material, owing to the dangers of navigation in summer. During some winters, there is comparatively little snow, and in the hope of experiencing this condition the bridge contractors purchased and delivered a large motor truck with trailer wagons. Their hopes were not fulfilled, however, and the heavy snow made this costly equipment quite ineffective. In one case, materials and plant were hauled by sleds about 150 miles over the frozen river, between points about 100 miles distant by the future railway but quite inaccessible by land. For another of the bridges, a considerable part of the material was carried on scows for nearly 300 miles.

Adding Hydrated Lime to Concrete Mixtures

SPECIFICATIONS usually call for hydrated lime as a certain percentage of the cement and the question often arises just how to proportion 10 per cent. or 15 per cent. of hydrate for the mix. A recent issue of the Mason Builder presents an interesting discussion of this problem.

Assuming that a sack of cement weighs 94 lbs., a 10 per cent. proportion would require 9.4 lbs. of lime hydrate. To secure this 10 per cent. dump the hydrate into a large wheelbarrow, or other convenient receptacle, and have made a box of the following interior dimensions: 8 ins. wide x 8ins. long x 6 ins. deep. This box, filled level full, should be added to the mixture for each bag of cement used. To secure 15 per cent. by weight of lime hydrate, have made a box of the following dimensions: 10 ins. wide x 10 ins. long x 8¼ ins. deep. This box, filled level full, should be added to the mixture for each bag of cement used.

Perhaps an easier way of measuring would be to use a bucket. An ordinary 8-qt. bucket, filled level full, contains the same number of cu. ins. as the first box named and would be equivalent to 10 per cent. by weight of a bag of cement. For a 15 per cent. mixture a bucket holding 14½ qts. or 3½ gals. should be used. As there is no bucket made of this size, it would be more convenient to use the 8-qt., or 2-gal. bucket mentioned above and fill it up one and a litle over half again for 15 per cent.

While discussing the subject of the use of hydrated lime for the purpose of "watertightening" concrete, it is well to dwell on the question of whether or not it is best to add the hydrate or to substitute it for an equivalent amount of cement. As an example let us say that we have a 1:2:4 mix. This gives 100 lbs. as a unit representing the cement. Adding 10 per cent. to this we would make 110 lbs. of cementitious material.

If the lime is considered as an addition it would not change the proportion of the sand or the aggregate and they would remain 200 lbs. and 400 lbs. If, however, the lime hydrate was intended to displace 10 per cent. of the cement, then the totals would be 110 lbs., including the cement and the lime, 220 lbs. the sand and 440 lbs. the aggregate.

There is still a third way of handling this proposition and that is to take out from the batch of cement an amount equivalent by weight to the lime put in. In other words, we would then have 90 lbs. of cement, 10 lbs. of hydrated lime, 200 lbs. of sand and 400 lbs. of aggregate.

Investigations which have been carried on for some time past tend to show that such substitution of lime hydrate does not weaken the strength of the concrete as has been contended in some quarters. Concrete in which a percentage of lime hydrate has been substituted instead of added, gradually gains in strength until at a certain period it becomes even with concrete made without lime. From this point on the concrete containing the hydrate continues to gain in strength at the same ratio. This, of course, refers to tensile strength, and since the concrete made with the lime hydrate is more nearly impermeable to moisture, it naturally follows that it would be the more permanent and enduring material of the two.

It is well known that the principal cause of disintegration in concrete is the absorptive nature of the material and in the proportion of absorption lies the length of life of the concrete. This is equally true of stones found in nature.

Recently the U. S. Government ordered taken down from one of the largest and most imposing structures in Washington some gigantic columns of sandstone which had begun to disintegrate and crumble away. The cause of the disintegration was the absorptive quality of the sandstone. Sandstone being somewhat like a sponge, absorbs water, and the constant expansion and contraction of this water held in the interstices of the stone causes the particles to become loose and in the case of the sandstone to scale off. Extremely hard stones such as granites and crystalline marbles are practically indestructible as far as the elements are concerned because they are known to have very little absorptive quality.

When concrete is produced without any voids or, in other words, a homogeneous mass into which moisture cannot penetrate, then we have a perfect concrete. This is what hydrated lime tends to accomplish when it is used intelligently. The addition of the lime hydrate not only makes the concrete mass more plastic and easier to manipulate, but it causes the concrete to flow more readily. In the case of concrete work for decorative purposes, the addition of hydrated lime has the effect of lightening the color of the cement and makes a more even and uniform job throughout.

Building Bridge Substructures on the Grand Trunk Pacific Railway

By W. C. Ruegnitz[1]

ONE of the most interesting features of construction on the Pacific Coast section of the new transcontinental line of the Grand Trunk Pacific Railway is the bridge foundation work along the Fraser River between Tete Jaune Cache and Fort George, in British Columbia. For 185 miles between these points the railway follows the Fraser River through several ranges of mountains, the distance by river being 300 miles. The country is wild and rugged, and inhabited mainly by Indians and trappers.

In the summer the melting glaciers and snow turn the streams into deep, swift rivers, and because of the scour and swift current exceptionally good foundations are required. Temporary bridges could not be maintained over the larger and more dangerous rivers, and it was necessary to complete the substructures in advance of track in order to allow the quick erection of the superstructure when tracklaying reached the various bridge sites.

There are ten permanent bridges, from 2,658 ft. in length to single-girder spans, and the three longest bridges cross the Fraser River. The substructure work of these bridges was commenced by some small individual contracts, but it was soon evident that it could not be carried on satisfactorily or with the necessary speed. In Feb., 1912, the contract for all the bridge substructure work from Tete Jaune Cache westward for some 450 miles or to within about 200 miles of Prince Rupert (the Pacific terminal) was awarded to the Bates & Rogers Construction Co., of Chicago. The writer was superintendent of construction for this company on the division between Tete Jaune Cache and Fort George, and work on this division was completed in May, 1914.

Supplies and Camps

To complete the difficult foundations in the short time allotted and under the conditions described, necessitated very careful preparation. Machinery, labor, plant and material were far away. Men were often shipped from Montreal and Boston, a trip of 10 to 14 days. Cement and steel from eastern Canada and Pennsylvania, requiring a lake and rail shipment, were often weeks in getting to destination. The base of supplies was at Tete Jaune Cache, at the end of the track. Here it was necessary to assemble all requirements to be freighted to the bridge sites.

The nature of the country was such that wagon roads were impossible, and the only means of delivering material was by boat or scow on the Fraser River, which is navigable only during the high-water period. Actual construction had to be carried on during the low-water period, which begins usually in October or November and continues until April or May. Thus the high-water period was a time of preparation. Camps had to be established quickly, and plant, supplies and material had to be assembled and stored at the various sites. The smallest details had to be carefully worked out in advance, as each camp would be without freight communication during much of the construction period.

Stern-wheel steamers of the usual river type were built to handle the freight but they could not begin to deliver all the enormous tonnage. Hence hundreds of scows 36 to 40 ft. long, 12 to 14 ft. wide, and carrying 12 to 25 tons each were floated to the jobs. They were handled by sweeps at both ends, each sweep being manned by two men. In the more dangerous canons and rapids, pilots and extra men were put on to assist the regular crews, but even with this precaution entire cargoes were frequently lost. The average mileage per day for a scow was fifty miles, while one would frequently make 70 miles. Their progress was augmented by the swift currents and the long summer days of the North.

Nearly all cement was delivered by scows that were from 5 to 14 days on the way. False bottoms, covered with straw to absorb the moisture, served as a floor to receive the cement. The sides and ends of the cargo were also protected by straw, while the top was covered with a heavy oiled canvas. Rim boards were provided to protect the cargo from the boat [illegible] by the river [illegible]. [illegible]

Engineering News.

[1] Superintendent, Bates & Rogers Construction Company of Chicago, Prince George, B.C., Canada.

ment left the mill until stored on the job it was handled eight times.

The camps presented exceptional requirements. Ample storage room was necessary to accommodate the material and supplies that had to be delivered in advance of construction. Preparation for the long cold winter had to be made, and bunkhouses of logs well banked were used when lumber could not be easily procured. Sanitary conditions had to meet the requirements of the British Columbia Government. During the fall, when it was impossible to deliver fresh meat from the base of supplies, cattle were driven to the camps or trappers furnished the contractors with caribou or moose meat.

When navigation was closed, the only means of getting to camps was by walking. Mail and small supplies were packed in. During the colder months, dog teams were used, and teams and sleds when the ice permitted. A single-line telephone system serving all the camps provided a wonderful help, although the line was not as good as the ordinary party line of the rural settlements. Most of the camps were located in heavily wooded districts, and fuel for all uses was cut during the summer months. Foundation piling and round timbers for construction purposes were cut in the fall and delivered to the sites by water before ice closed the river. Square timbers were hewed on the job, there being many expert broad-axe men available.

Substructure of the Fraser River Bridge

All the bridges presented special difficulties but the largest and most interesting is that at Fourth Crossing, one mile east of the old Hudson's Bay Company Post, known as Fort George. It is just below the confluence of the Fraser and Nechaco Rivers. Here the line crosses an island, with the deep-water channel, known as the Fraser, on the east side, while the Nechaco, an overflow channel during high water, is on the west side. The length of the bridge is 2,658 ft. There are ten spans of 200 ft. and two of 250 ft., one at either end of the 100-ft. lift span. The truss-seat elevation at pier No. 1 is 1,867 ft. above sea level, and the elevation of the river bed is 1,823 ft. High-water level is assumed as 1,858 and the low water as 1,839.

The ideal location of the island was utilized by the contractors for their camp, accommodating 600 men. This was laid out in streets. The bunkhouses were frame buildings covered with prepared roofing. The storehouses for cement and material were large frame buildings covered with heavy oiled tarpaulins or "tarps," an exceptionally fine canvas made in Scotland. Tarps that had protected the cement on the river trip were used to cover the buildings. An auxiliary camp to accommodate 100 men was established on the east bank, on account of the great danger in taking laborers across the main channel during the ice floes before the contractors' temporary bridge was completed. This proved very fortunate, for in the spring, when the ice took out all temporary structures, the work on the east bank was carried on without interruption.

A complete day and night organization was maintained for the entire work, each pier having a complete plant layout as well as an individual crew. A night and day foreman for each pier worked together, shifting their crews every two weeks. Each foreman reported to the general foreman, there being one general foreman for each shift. The general foreman reported to the superintendent in charge, who was located on the work.

The substructure consists of 12 concrete piers and two abutments, all resting on pile foundations, as shown. The deepest foundations are at piers Nos. 1 and 2, which were carried 25 ft. below low water, requiring 40-ft. steel sheeting. An ice jam which raised the water several feet above the top of the sheeting delayed the operations for several days. Careful soundings were taken before the work was started and showed a gravel bed with an underlying strata of very stiff sandy clay with layers of quicksand. The depth of gravel varied at different pier sites.

An exhaustive study of the individual pier and abutment sites was made by the contractors, and cofferdams were designed both as to kind and strength to suit the local conditions. Three types of cofferdams were used; crib, steel sheeting and a single row of Wakefield wood sheeting. The size of cofferdams was designed to allow ample room for the necessary cofferdam piles, bracing and timbers. The braces were spaced in order to allow of dredging with grab buckets and to permit the placing of pumping equipment.

Actual work on the shore was commenced in September, 1913, on the east abutment and pier No. 6, the only units then accessible. The temporary bridge from which all work was directed was started at this time and carried out as far as navigation laws permitted. Later, when floating ice stopped navigation, it was found a very difficult task to drive the remainder of the bridge and it was not until January that it was entirely completed. The river, with a current of 4½ to 5 m.p.h. and filled with ice, presented a formidable obstacle not only against the temporary bridge but it seriously hindered the placing of the cofferdams.

The general program of construction for each pier was as follows:

1. Open dredging was carried down as far as possible.

2. The cofferdams were then built. The crib cofferdams were built and sunk in the ordinary way. For the steel cofferdams, wood piles spaced 8 ft. centre to centre were driven around the space to be inclosed; these were carefully lined up and two sets of timbers 4 ft. apart bolted on the inside piles (above the water) to act as guides for the steel sheeting. Three or four complete sets of waling and bracing were then sunk into position and set as deep as possible. The steel sheeting was then set inside the guide timbers and around the waling, care being taken to get a locked dam. After closure the steel was driven the full depth required, usually 6 ft. below the elevation required for the bottom of the foundation.

3. Excavation inside the cofferdam was continued with dredges teeth being used on clam-shell buckets when clay was encountered. The waling and bracing was usually carried 1 to 2 ft. below the bottom elevation required, in order to allow for swell caused by driving the foundation piles.

4. When excavation was completed, the foundation piles were driven and cut off under water at the eelvation required by means of a saw. The penetration of this piling usually averaged over 20 ft. below cutoff. The driving was very hard.

5. Concrete was then placed under water by means of bottom-dump buckets, using a 1:2:4 mixture. The amount of sealing used was carefully figured to prevent floating or "blow-in." The sealing was allowed to set from two to six days, depending upon the depth of water and temperature.

6. When the concrete was properly set the cofferdam was pumped out. As the water was lowered, the

bracing was examined and strengthened or repaired if necessary. The results in all cases showed exceptionally good masonry.

7. Forms were built and the pier concreted, using 1:3:5 mixture, the necessary precautions being taken (as described below) to protect it against severe weather.

Concrete Work

For the Fraser Channel, two concrete plants were used, one on the island and one on the east bank. Gravel was taken from the river and stored in a network of hollow boxes into which steam was turned, thus keeping the gravel hot even during weather 50 deg. below zero. Cement which had been delivered by scow was stored at both mixer plants. The concrete was taken from the mixer to the piers in buckets on cars handled by an endless cable. It was delivered so quickly that it was not affected by the cold before being put into the forms.

On the Nechaco Channel, enough gravel was obtained from the excavation of each pier, and a mixer was set up at each pier; the only material to be hauled being cement.

To prevent freezing, the gravel was heated as mentioned above. Water was also heated, the mixed concrete coming to the forms very warm. The forms were entirely covered by heavy oiled canvas tarps, these extending from the top of the cofferdams to the top of the forms, completely inclosing the pier. Between the forms and canvas covering, fires were kept in small stoves, or steam heat was furnished in radiators built on the work. Both methods are good but steam was preferred and used where there was an available supply on account of danger of fire from the stoves.

Steam was always turned in at the top of pier when completed. Heating was continued for 3 to 7 days after masonry was placed and the forms were stripped in from 7 to 10 days. The results obtained were remarkable. The masonry is smooth and of a uniform color and there are no indications that frost penetrated anywhere.

The forms had to be well built and braced with more than ordinary care before placing concrete, because the canvas covering did not leave an opportunity to examine the forms to determine if they were being kept in line.

Progress Records

The weekly progress report used by the contractor was a white print 28 ins. long showing an elevation and plan of the bridge (on which the concrete progress was marked) and a profile of the river bed on which the progress of coffer-dams and pile foundations was marked. On the print was a table for the excavation, coffer-dam, piling and concrete at each pier, the table being filled in each week. In addition to this, a monthly report was made for each pier or abutment, showing the progress, materials used, etc., and the condition of the work. These graphic reports were made up at the superintendent's office and forwarded to the main office of the contractors in Chicago.

For fireproofing and for various other purposes requiring low stresses, cinder concrete is often used. The cinders should consist of hard, clean, vitreous clinker free from sulphides, unburned coal and ashes. Clean cinders will not discolor the palms of the hands when rubbed between them.

The Selection of Dust Preventives

THERE are many factors to be taken into consideration in selecting a proper dust preventive, chief among them being the type of road under consideration, the condition of its surface, the character of the traffic and the standard of living of the community, as well as the amount of money available. Although the method employed under one set of conditions might be entirely unsuitable for another, in a general way it is possible to obtain satisfactory results by the careful selection of materials.

Pavements.—Inquiries have been received by the State Highway Department as to the method of laying the dust on a brick street, and the advice has been to "clean it." Attempts have been made to apply oil and various preparations for retaining the dust on such pavements, but such methods are to be condemned. The only satisfactory way to keep brick, asphalt, wood block and concrete pavements clean and dustless is to sprinkle and sweep them, or in some cases, flush them with water under pressure. There will ordinarily be no dust nuisance on such pavements built in rural districts with sunken curbs, as the rain water will keep them clean.

Suburban Roads.—The suburban stone road offers the widest choice of methods of dust suppression, the choice depending largely upon the degree of permanency desired. For the most lasting results, either the heavier tars or asphaltic oils may be used, while for less lasting results the choice lies between the lighter oils or tars, the emulsions, calcium chloride and various patented preparations. If there are hydrants at convenient intervals along the road, salt solutions or emulsions may be used. If an emulsion is to be used, that product containing the greatest amount of binding base per unit cost should be selected, unless it possesses some other quality such as a strong, disagreeable odor which makes it undesirable. While, as stated, the selection of the material must be governed by local conditions, it is believed that in most cases the more permanent methods of dust suppression will be the more desirable.

Park Roads and Race Courses.—These are considered together not necessarily because of a similarity in type, but because the temporary binders are especially suited to both types. On such roads the traffic conditions are considerably different than on other types. In the case of a speedway, the use in general is limited to a very short time, while traffic on park roads is chiefly confined to the summer months. It is, therefore, obvious that in many cases the best economy would not be obtained by the use of the more permanent dust preventives. A treatment of calcium chloride has proven very satisfactory for race courses; and for park and similar roads, subjected to traffic for a longer time, oil and tar emulsions have been used advantageously.

Rural Roads.—The number of methods of dust prevention to select from for roads of this class is much more limited than in the case of suburban roads. It is apparent that the temporary treatments are not applicable to most country roads for the reason that a convenient water supply, required for the use of the oil emusions and salt solutions, is not available. Rural roads may be classified as hard roads and soft roads, hard roads including brick, concrete and mac

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[illegible] Dust Preventives, Bulletin No. [illegible], Ohio State Highway Department.

adam and soft roads including gravel and earth, the gravel sometimes being worthy of a place in the first classification. The material to be selected will depend upon the kind of road to be treated. Brick and concrete roads will be maintained in a comparatively dustless condition by rain water and need not be considered further. The most satisfactory method of treating macadam is by a surface treatment of hot asphaltic oil or refined tar covered with gravel, slag or stone chips. Other things being equal, this method is recommended in preference to cold treatments with lighter oils and tars, for although these are applied at a much less cost the results are not so lasting. If, however, the road cannot be cleaned so as to expose the large stones in the surface the lighter oils and tars are likely to give the better results. Provided both are of suitable grade and of good quality, there is not much preference between oil and tar of this class of work. A good tar is preferable to a greasy paraffin oil, and a good asphaltic oil is far better than a poorly prepared or high temperature tar. Gravel roads have been treated with both oil and tar, but more generally with the former. In the case of a good, hard gravel road, practically the same treatment as recommended for macadam may be applied. The cold surface treatment has been used to a greater extent than the hot treatment for this type of road, and Glutrin has also been used to some extent.

It may be said in conclusion that it is essential to give careful consideration to all local conditions governing the selection of proper material and the proper method of application. Care must also be taken to secure good quality in the material which is selected, which means that the material should be examined and tested. It is also important that the treatment should be renewed as soon as the condition of the road demands it, if it is desired to maintain the road in good condition and free from dust.

Quebec Bridge Anchor Arm Diagonal and Posts

Description of Largest Web Members of 515-Foot Trusses, Which are Erected in Several Units

THE principal web members of the 515-ft. anchor arm trusses of the Quebec Bridge are all of unusual length and weight, reaching or approaching the limits of transportation and, whether for compression or tension stresses, are of rivetted construction. Most of them are designed with four webs of built channel or I-beam section which are strengthened by longitudinal and transverse diaphragms, the flanges being connected by tie-plates and latticing. The largest intermediate post of all, L12-U12, and the two adjacent diagonal members M12-U14 and M12-L14 have four webs and are shipped and erected in halves. The tension diagonal M12-U14 is shipped and erected in halves which, after erection, are connected by three tie-plates, in order to keep the member as a whole in line. All pins are finished to an accuracy of 1/1000 in., pin holes being bored 1/32 in. + 1/100 in. larger than their pins.

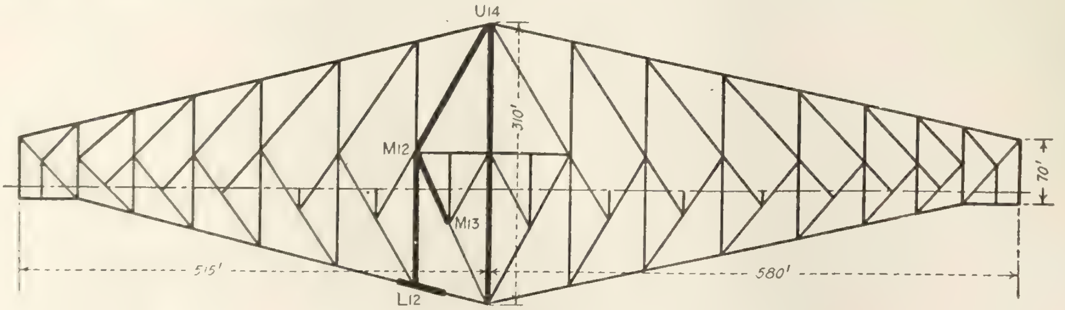
The diagonal M12-U14 is 154 ft. 11⅛ in. long over all, has a cross-sectional area of 391 sq. in., a total weight of 308,700 lbs. and is shipped and erected in halves. The webs are 48 ins. deep and 22 ins. apart, with their flanges turned in and latticed. The lower end is bored for a 16-in. pin and the upper end has a 16 x 18-in. hole providing a 2-in. adjustment to take care of any settlement of the falsework or deformation of the members under their own weight during erection. Each half of the member weighs 154,300 lbs. and will be shipped in two parts, but will be field rivetted before being erected.

Vertical Member L12-M12

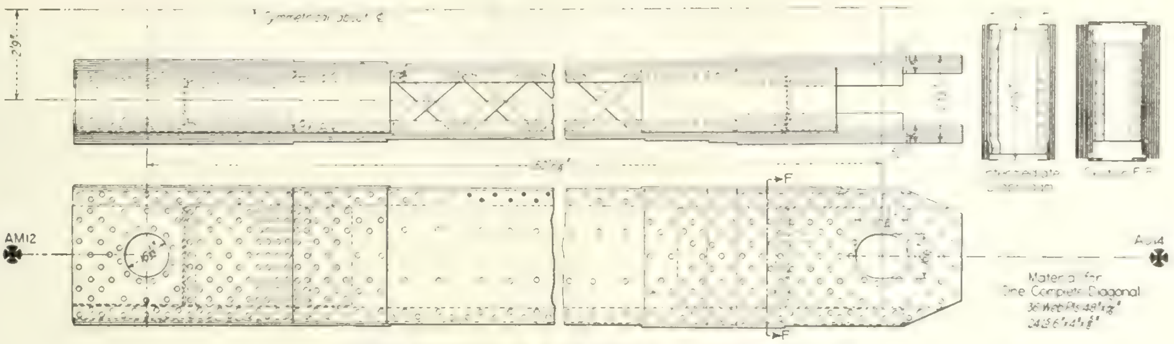
The lower half of L12-M12 of the vertical tension member at panel point 12, is 130 ft. 8 1/16 in. long over all, weighs 232,000 lbs. and has a cross-sectional area of 373 sq. ins. Each half is symmetrical about the axis and will be shipped separately and field rivetted together with idaphragms and tie-plates. The halves, 5½ ft. apart on centres, each have a 2 x 4-ft. rectangular cross-section made of two built channels with multiple plate webs, and have their flanges turned in and latticed with bars. The webs of each half are connected by transverse diaphragms at the ends and at four intermediate points. The tie-plates, nearly 12 ft. long, which connect the two halves of the member at an intermediate point, are bored for an 11-in. pin parallel to the bridge axis, which supports the floorbeams.

Diagonal M12-M13

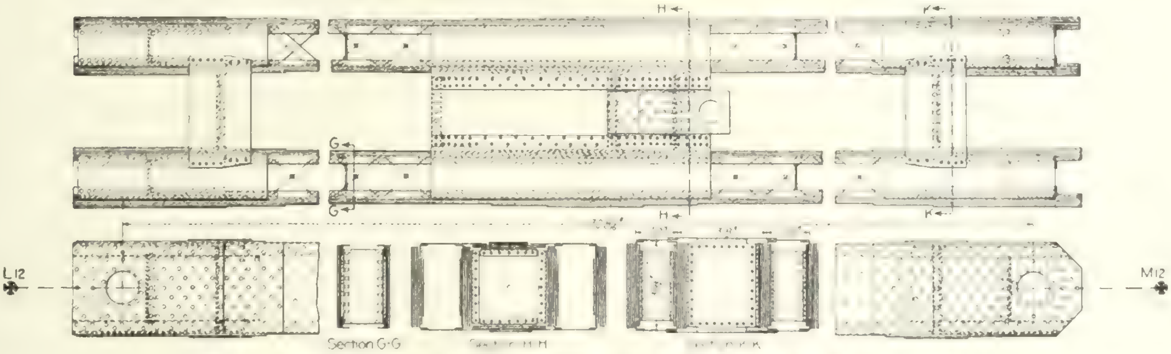
The upper portion of M12-M13, of the main compression diagonals M12-L14, is about 82 ft. long over all, weighs 295,000 lb. and has a cross-sectional area



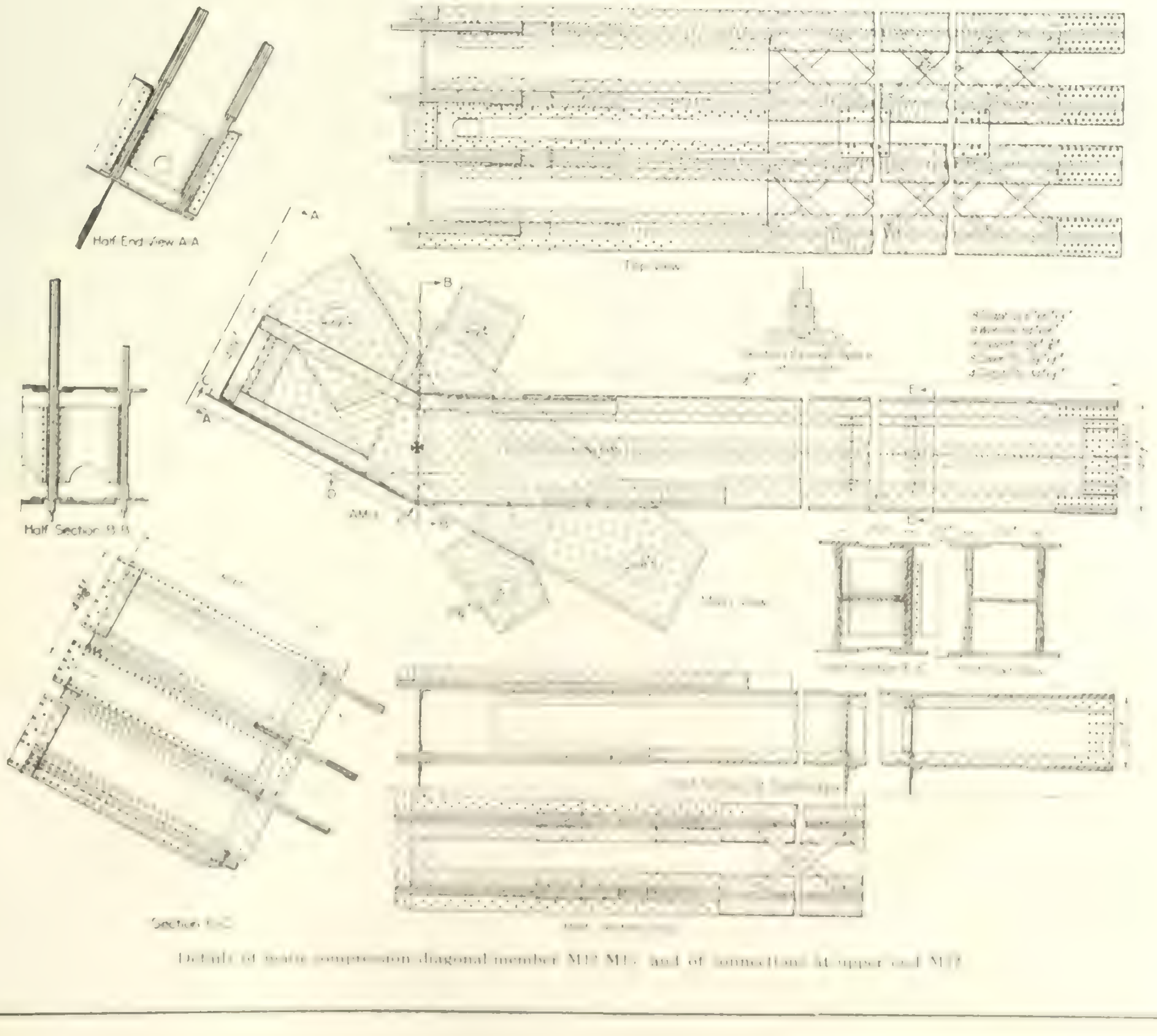
Location diagram of cantilever and anchor arms.



GENERAL ELEVATION OF MAIN TENSION DIAGONAL AM12-AU14



Details and field-rivetted splice of twin members of lower part of vertical post L12-M12.



Details of main compression diagonal member M12-M14 and of connections at upper end M12 of [illegible] sq. ins. The main body is symmetrical about the centre line, has four webs, and is shipped and erected in two halves. These duplicate sections are spaced [illegible] ft. apart on centres and connected by field-rivetted flange tie plates. Each half member is made of a pair of built I-beams 4½ ft. deep and 2 ft. apart on centres with their flanges latticed. Their webs are also connected by transverse diaphragms and by tie-plates on the centre line.

At the lower ends the webs and flanges are spliced by field-rivetted flange and web splice plates to the lower part, M13-L14, of the same diagonal, and at the upper end four sets of reinforced gusset plates are shop rivetted to the webs and project beyond both flanges to receive the connection pins of the diagonal, horizontal and vertical members of the truss intersecting it at this point.

Main Vertical Post L14-U14

The main vertical post, 310 ft. high on centres, has a 9-ft. 2-in. by 9-ft. 10-in. cross-section with an area of 1,903 sq. ins. Including the eyebar connection detail at the top, and the detail at the lower end, which transmits the load to the pedestal, this post has a total weigh of 2,724,000 lbs. For convenience in fabrication, handling, shipping, and erection, it is made with twenty-six transverse and longitudinal field-rivetted splices. The middle section is 36½ ft. long and each of the other four intermediate sections 55 ft. long with maximum shipping weights of 120,000 lbs. each for the four pieces. The post is symmetrical about the longitudinal and transverse centre lines and each of the five intermediate sections is composed of four H-shape column sections connected to gether by field-rivetted latticing and tie plates. Each H-shape unit is 3½ ft. by 4½ ft. in cross-section and is made up of two built I-beam sections 3½ ft. deep.

Each of the four units in one of the intermediate sections of the posts has fourteen 8 x 8 x 13/16-in. flange angles, eight 19 x 9/16-in., two 19 x ⅝-in. flange plates and two 30 x 11/16-in. and six 37 x 11/16-in. web plates. The lattice bars are made of 8 x 13/16-in. and 8 x 11/16-in. bars.

In the short end sections of the posts the pairs of units are connected by wide cover plates parallel with the bridge axis, which engage both flanges of each unit. At the foot of the post the bearing is made with a 30-in. pin bushed to 45 in. but in the upper end detail, which alone is made of nickel steel, the bushing is eliminated and connection is made by a 30-in. pin to a rivetted nickel steel link bored also for the pins for four separate sets of top chord eyebars and for the pins for two diagonal members.

The centre section of the post is provided with pairs of longitudinal gusset plates projecting beyond the flanges and bored to receive pin connection for subdiagonal and horizontal truss members in both the anchor and cantilever arms. The horizontal longitudinal strut connected to the post at this point is provided with a telescopic adjustment to permit the post to be erected in a temporary position 15 ins. out of plumb at the top and afterwards to be moved into a vertical line.

All concrete specifications for important structures should definitely require that the sand shall be actually tested in a laboratory with the brand of cement to be used in the structure, and shall be rejected if it does not reach the standard strength in tension and compression.

Concrete Poles and the Possible Maximum Loads on Pole Lines

It is widely conceded among engineers who are confronted with the task of providing a suitable substitute for the present timber pole that the concrete product is the only practical solution of the problem. The two foremost points in which the concrete pole is superior to that of wood are the facts that a properly constructed concrete pole is practically everlasting, and that almost all such poles can be designed so as to make them much stronger and far more stable than the timber product. Aside from the actual strength of wires, the stability of all supports for electric conductors is the main factor which governs the length of wire spans, and inasmuch as the stability of concrete poles can be made greatly to exceed that of wooden poles, the fact is probably established that extremely long wire spans will accompany the advent of concrete poles for general use.

Many engineers have published figures representing the possible theoretical loads on pole lines, the main factor in all such calculations being an assumed violet wind pressure acting against ice-covered wires. In addition to this the assumption is also made, that the above conditions may be accompanied with a temperature of 10 deg. below zero, and that the consequent contraction of the wires might cause them all to break in the same span. It is claimed in this connection, under the above conditions, with the wind blowing in a direction parallel to the wires, that the maximum load occurs in this direction on the pole next adjacent to the broken span.

The foregoing conditions are apparently very uncalled for assumptions; statistics have shown that such a simultaneous combination of the elements is a very rare occurrence. No engineer attempts to figure any structure against an earthquake or a cyclone; still such calamities may occur in any locality, at any time and just as frequently as the foregoing combination of conditions. Viewing the situation from the standpoint of the purchaser who invests his money in the construction of pole lines, one must realize the vast importance of considering the interest on the increased capital which is necessary to make such work proof against conditions which so rarely occur.

Owing to the peculiar action of the catenary curve in horizontally suspended wires, a very slight movement of the wire at its point of attachment to the cross arm, will materially affect the sag at the centre of span, and it is unreasonable to conceive of any suitable attachment betwen the wire and the insulator, which will not allow such wire to slip, in case of breakage of wire, so that the sag will touch the ground at the centre of span and relieve the pole from about 50 per cent. of the extreme load against which it is usually figured.

The vertical load on any support for electric conductors is of little consequence as compared with the possible side pull in a horizontal direction at right angles to the wires. A properly designed concrete pole, therefore, should be widest at the ground line and tapering both ways therefrom; provided, however, that the bases of such poles are designed with sufficient area so as to support the combined weight of ice-covered wires. The width of the pole at the ground line should be made so as to resist the horizontal action of wind pressure blowing at the rate of 70 miles per hour, at right angles to wires covered with ½-in. of ice.

Many high tension transmission lines have been constructed with spans up to 1,200 ft. Such long spans are made possible through the use of steel towers with wide bases. There seems to be no authentic reason why trolley wires for electric railways should not be hung on longer spans than are now being used in connection with standard construction of such lines. The only apparent objection to long spans for such service is the sag in trolley wires which must be reduced to a minimum on account of the limited movement of the trolley pole. Through the use of the well known catenary suspension in which the trolley wire is supported from a messenger cable, the sag in trolley wires can be eliminated entirely, and the length of spans in such lines is governed only by the economical strength of the messenger cable. Owing to the possibility of cross-circuits being caused by the side sway in telegraph and telephone wires, the use of long spans in this connection has been questioned. It seems reasonable to believe, however, that this objection can be overcome through the use of insulators staggered alternately above and below the cross-arm, and while we believe that minimum increases in wire spans can be accomplished with telegraph and telephone lines, still there is really no authentic reason against the adoption of increased spans for all concrete pole lines which are erected for the support of electric conductors.

The development of concrete poles and the improved method of setting them result in extreme stability, greatly increased spans and a consequent reduction in first cost per mile, through the elimination of many poles, cross-arms, insulators, and labor. For example: An ordinary pole line using 50 30-ft. cedar poles per mile, set up with cross-arms and insulators attached, ready for wires, costs in this vicinity, about $650 per mile, with a probable life of 15 years and the possibility of renewing it entirely after every storm of any consequence. Substituting good concrete poles for this same service, using 30 30-ft. poles per mile, set up with all attachments ready for wires, the cost per mile will not exceed $600 and the line will last indefinitely.

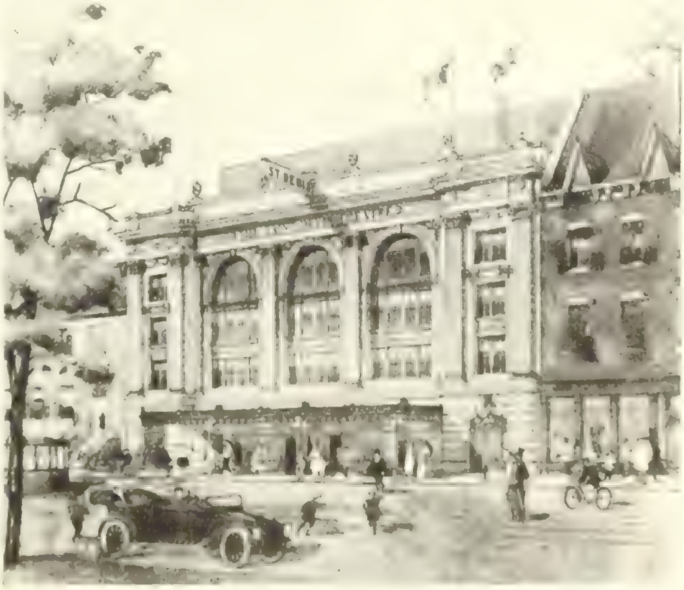
In view of the above conditions, it does not require any great amount of forethought on the part of the conservative pole purchaser to realize that concrete poles will eventually not only solve one and all of his present pole troubles, but, that, in the long run a saving of many thousands of dollars can be effected through the elimination of constant maintenance, frequent renewals and unnecessary first cost of heavy construction.—Concrete Cement Age.

Optimism from Sherbrooke

The City Engineer of Sherbrooke, Mr. Thos. Tremblay, sends the Contract Record and Engineering Review quite a cheering report on the status of business in that city. Conditions generally, he reports, are good. The machine shops and steel manufacturing plants are working on short time, but some manufacturing industries are benefiting by the war, having received large orders from the Government. The city is undertaking all the permanent work possible, with a view to maintaining employment. The works now in progress comprise a considerable amount of brick sewers and water mains. Concrete sidewalks are in course of construction on a number of streets. Next season's work will entail large expenditures, particularly in regard to the extension of sewer and water mains. Concrete sidewalks are in course of construction on a number of streets. Next season's work will entail large expenditures, particularly in regard to the extension of sewer and water mains. Mr. Tremblay refers to the possibility of a start being made on the trunk sewerage system, plans for which he is now preparing and which will cost perhaps $500,000. Paving and concrete sidewalk construction will probably mean an additional outlay of $150,000. The works carried out in Sherbrooke so far have been done on money raised by the issue of debentures more than a year ago, consequently no financial difficulties have been encountered so far.

Large New Picture House for Montreal

Messrs. Barott, Blackader and Webster, Montreal, (with Mr. A. E. Westover, Philadelphia, as consulting architect) have drawn up plans for a very large moving picture theatre, to be erected on St. Denis Street, between St. Catherine and Ontario Streets. The site is 120 x 195, and the theatre will provide accommodation for 3,000 people. The front section of the building will consist of floors of offices, while on the ground floor there will be accommodation for four stores. In addition to the auditorium, there will be a very large gallery, cantilever construction being employed so as to eliminate all columns and to give an interrupted view of the stage, which will be 33 feet deep. Exits will be provided on the four sides, enabling the theatre to be emptied in eight minutes. The building will be fireproof, and of steel and concrete construction. The exterior is to be of glazed terra cotta with a limestone base; the interior will be of plaster and imitation marble, the decorations being in the Adams style. The entrance will have an ornamental marquee. The ventilation system is to be by means of forced air, and the ventilating and heating apparatus will be located in the basement and under the stage. There will be a duplicate heating plant for use in the event of breakdown. Ventilating fans will be installed on the roof. To guard against fire, the cinematograph machines will be housed on the roof.

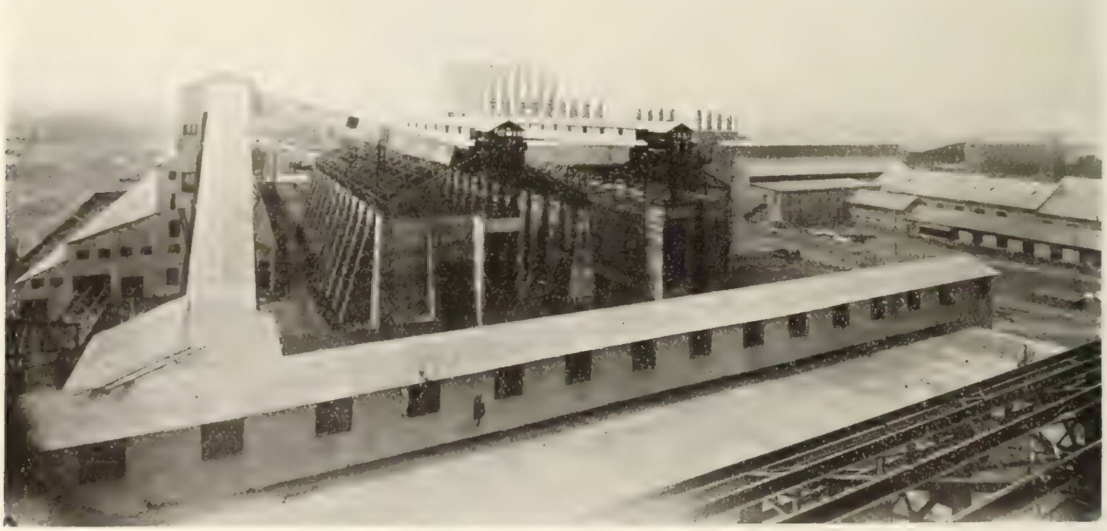


Proposed St. Denis Theatre, Montreal.

Arrangement and Operation of the Canada Cement Company's Plant No. 1

THE plants of the Canada Cement Company, Limited, are numbered from east to west, hence the plant described in this article, which is the farthest east, is designated as Plant No. 1. The original plant was built in 1907 by the Lakefield Portland Cement Company, and, together with Plants No. 2 to No. 10 inclusive, passed into the hands of the Canada Cement Company, Limited, in 1909. Since that time additional property has been acquired and extensive additions have been made to the plant, increasing its capacity from 1,200 barrels per day to a capacity of 12,000 barrels per day.

The property is situated about nine miles east of the centre of Montreal, on the north bank of the St. Lawrence River. At the foot of the company's property, the Harbour Commissioners of Montreal are now building a concrete dock five hundred feet long, which, when completed, will be leased to the company and will provide facilities for receiving coal on the site of the plant, and for shipping cement direct by water to the ports of the Maritime Provinces and the Great Lakes.



View of plant from top of Stock House No. 4 (during construction.)

The Canadian Northern Quebec Railway and the Montreal Terminal Railway (electric) cross the property. The former connects with all steam roads entering Montreal, and the latter permits of delivery to all parts of Montreal and its suburbs by street railway flat cars.

The plant is operated on the dry process, coal being used in the kilns. The raw materials are rock and clay, both of which are obtained close to the plant, but the composition of the rock is such that only a very small proportion of clay is required.

The plant is electrically operated throughout, all the larger machines having individual motors and the smaller ones being grouped. The power, which is purchased from the Montreal Light, Heat & Power Company, is delivered at 10,000 volts, 60 cycles, 3 phase, and is transformed to 550 volts for motors and 110 volts for lighting.

Water is supplied from the river by motor-driven turbine pumps. All departments are connected by telephone to the plant office, stores and electric substation. There are some six miles of railway track on the property, owned and maintained by the company, upon which both railways operate.

The original plant had a capacity of 1,200 barrels per day. This was first increased to 4,000 barrels, and later to 6,000 barrels per day. The original plant, together with these extensions, is now known as "Mill A." Before "Mill A" was completed a further extension was decided upon, and this extension, which was completed within the past year, is now known as "Mill B." It is arranged as a separate unit of 6,000 barrels capacity, but the kilns are placed alongside the kilns in "Mill A," forming one long kiln department, which is supplied with fuel from a single coal department. Three of the kilns in the centre of the department are arranged to receive their feed from and to discharge their clinker to either mill, for the purpose of balancing operations. The raw and clinker grinding departments in "Mill B" are combined in a single unit, and the machines are so arranged that part of them can be used for grinding either raw material or clinker, as required.

The block plan reproduced herewith shows the general arrangement of the plant, its division into mills "A" and "B" and the sequence of operations.

The quarry, which is immediately adjacent to the mill, is at present worked to a depth of about 55 feet. Most of the drilling is done by electrically-operated well drills, but air drills are used on some of the lower benches and for sinking purposes. Three 75-ton steam shovels load rock into standard gauge side-dump cars, which are pulled up inclines to the crushers by electric hoists.

Rock Crushing, Storage and Drying.—In "Mill A"

Kominuters and Tube Mills in Grinding Department, Mill B (during construction).

the crusher equipment consists of a No. 11 gyratory crusher, followed by two pairs of 54-in. x 24-in. crushing rolls. The crushed rock is delivered by two 24-in. bucket conveyors either to storage or to bins over three 6 ft. x 100 ft. dryers.

In "Mill B" the first crushing is done by a 36-in. x 60-in. Fairmount crusher, which discharges into a 60-in. inclined pan conveyor. This conveyor discharges into a 7 ft. x 19 ft. rotary screen with 2¾-in. perforations. The tailings are fed to three No. 6 gyratory crushers, the product of which, together with the "fines" from the screen, is delivered to two bucket conveyors, which carry the rock to large concrete bins back of and above the dryers. The capacity of these bins is sufficient for two days' run. This dryer department contains nine 7 ft. 6-in. x 60-in. rotary dryers, each of which is installed directly back of a 9½-ft. x 150-ft. kiln, in such a way that the heat of the gases from the kilns is utilized in the dryers. The dryers discharge the rock into two bucket conveyors, which carry it to the raw mixing department, from which a belt conveyor then carries it to the grinding department.

Kilns.—For convenience of inspection, the kiln department will be considered before passing to the new grinding department. The grinding department of "Mill A" will be dealt with later. The kiln equipment consists of four 8 ft. x 110 ft., four 8 ft. x 125 ft. and nine 9 ft. 6 in. x 150 ft. kilns. The first eight of these kilns operate in connection with "Mill A," and the last six with "Mill B." The three kilns in the middle, Nos. 9, 10 and 11, may receive raw material from

Stock House No. 1 (during construction).

either "Mill A" or "Mill B," and discharge clinker to "Mill A" storage or to one of the bucket conveyors leading to "Mill B" storage.

Vertical coolers are used in connection with "Mill A" storage, but no coolers are provided for "Mill B" storage, as it has a capacity of 400,000 barrels of clinker, and is divided into two compartments, so that while hot clinker is being dumped into one, the cool clinker is being drawn from the other. Clinker is put into and taken out of all of the storages by means of bucket conveyors.

Grinding Department "Mill B."—This department contains both the raw and clinker grinding under one roof. The equipment consists of fifteen No. 85 kominuters and nineteen No. 18 tube mills in parallel rows. The feed bins are placed in a line between them, and the drives for the mills project through the walls into motor sheds on the outside. Five kominuters and five tube mills in the middle have their feed and discharge conveyors so arranged that they can be utilized on either material.

The rock and clay mixture is brought from the mixing department by belt conveyors, with a tripper for discharging into the kominuter bins. Clinker is brought from the bucket conveyors of the storage by a 24-in. belt conveyor to a mixing tower, where the gypsum is added. From the bins in the mixing tower a 24-in. belt with a tripper carries the clinker to the bins over the clinker grinding kominuters. This belt runs over a weightometer, giving a continuous record of the number of barrels ground.

The material from the kominuters is elevated and fed to the corresponding tube mills, from which the raw material is carried by a belt conveyor to the kiln department, and the finished cement by a belt conveyor to the stock house.

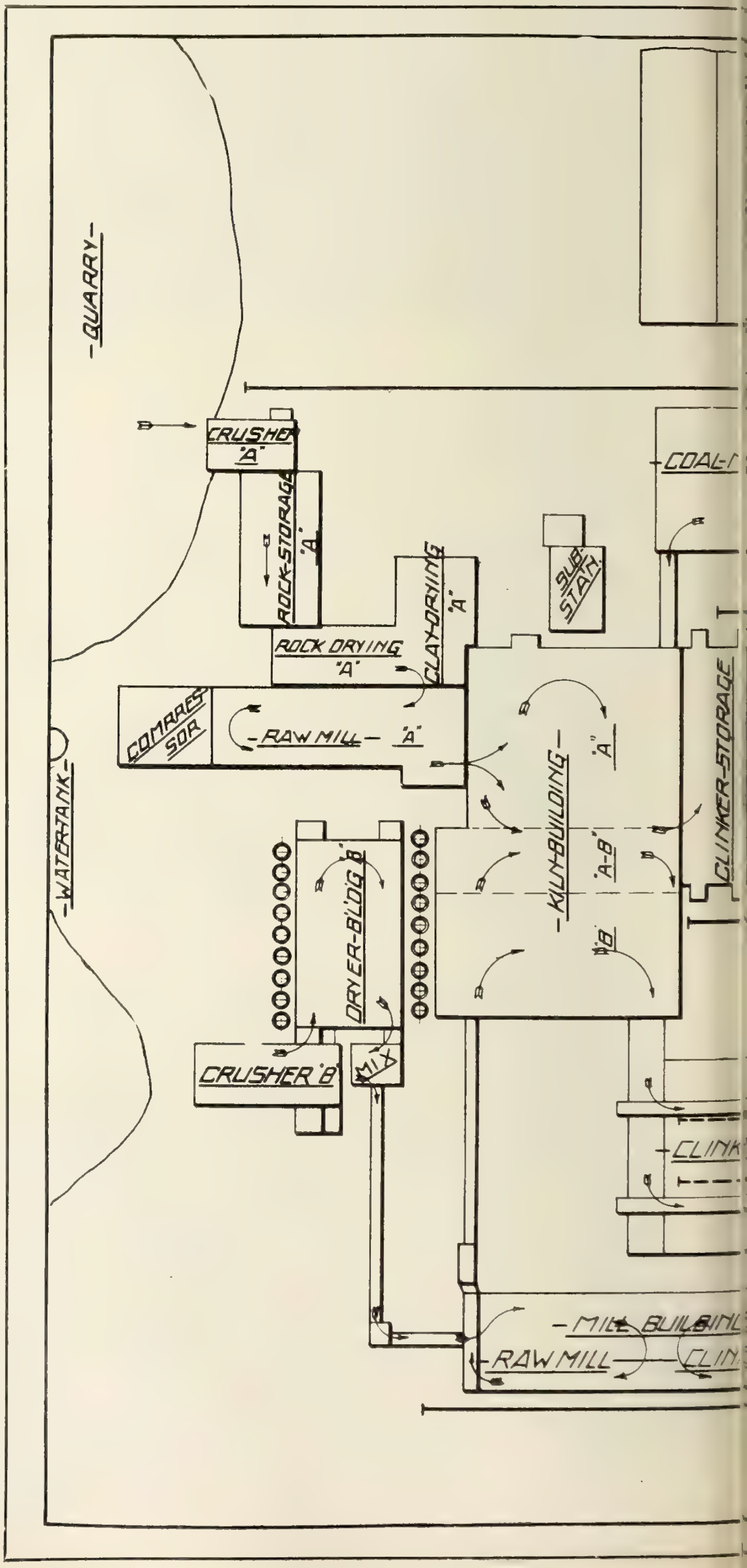
A gypsum storage with a capacity sufficient for five months' run is provided in connection with "Mill B." The gypsum is put into and taken out of this storage by an 18-in. bucket conveyor. In taking gypsum out of storage the bucket conveyor discharges on to a belt conveyor, which carries the gypsum to the mixing tower, where it is added to the clinker.

Stock Houses Nos. 3 to 6.—Owing to the long winter season, with its necessarily small demand for cement, the output for practically the entire year must be shipped in about seven months. This requires large storage and packing capacity. To meet these conditions, the company has evolved a type of stock house which is particularly satisfactory from the standpoints of convenience, capacity and design. Stock Houses Nos. 3, 4, 5 and 6 are of this type. They are 100 ft. x 200 ft. x 50 ft. high to top of walls, with the exception of No. 3, which was constructed first, and is only 40 ft. in height.

Each stock house is made up of a row of 20-ft. square bins around the four sides, enclosing a central storage 60 ft. x 160 ft. The walls are of reinforced concrete and the roof construction of steel. The bins are filled by a 24-in. belt conveyor with a tripper in the monitor. Cement is drawn out by 16-in. screw conveyors in cross tunnels beneath the floor, spaced 20 ft. centres. These discharge to a 30-in. belt conveyor, running longitudinally in an alley, just outside the foundation. Spouts in the floor, above the screw conveyors, allow for drawing from any of the small side bins or from the central storage. When filled to capacity, each stock house holds about 300,000 bbls.

Stock Houses Nos. 1 and 2.—Stock Houses Nos. 1 and 2 are of reinforced concrete with buttressed walls. They also have screw conveyors beneath, spaced 20 ft. centres, discharging to a belt along the front. Their capacity is about 120,000 bbls. each.

Distribution of Production.—The distribution of cement to these storages is as follows: "Mill A" discharges to Stock Houses Nos. 1 and 2 in one direction and to No. 3 in the other, by inclined belts. "Mill B" discharges by an inclined belt to Stock House No. 4

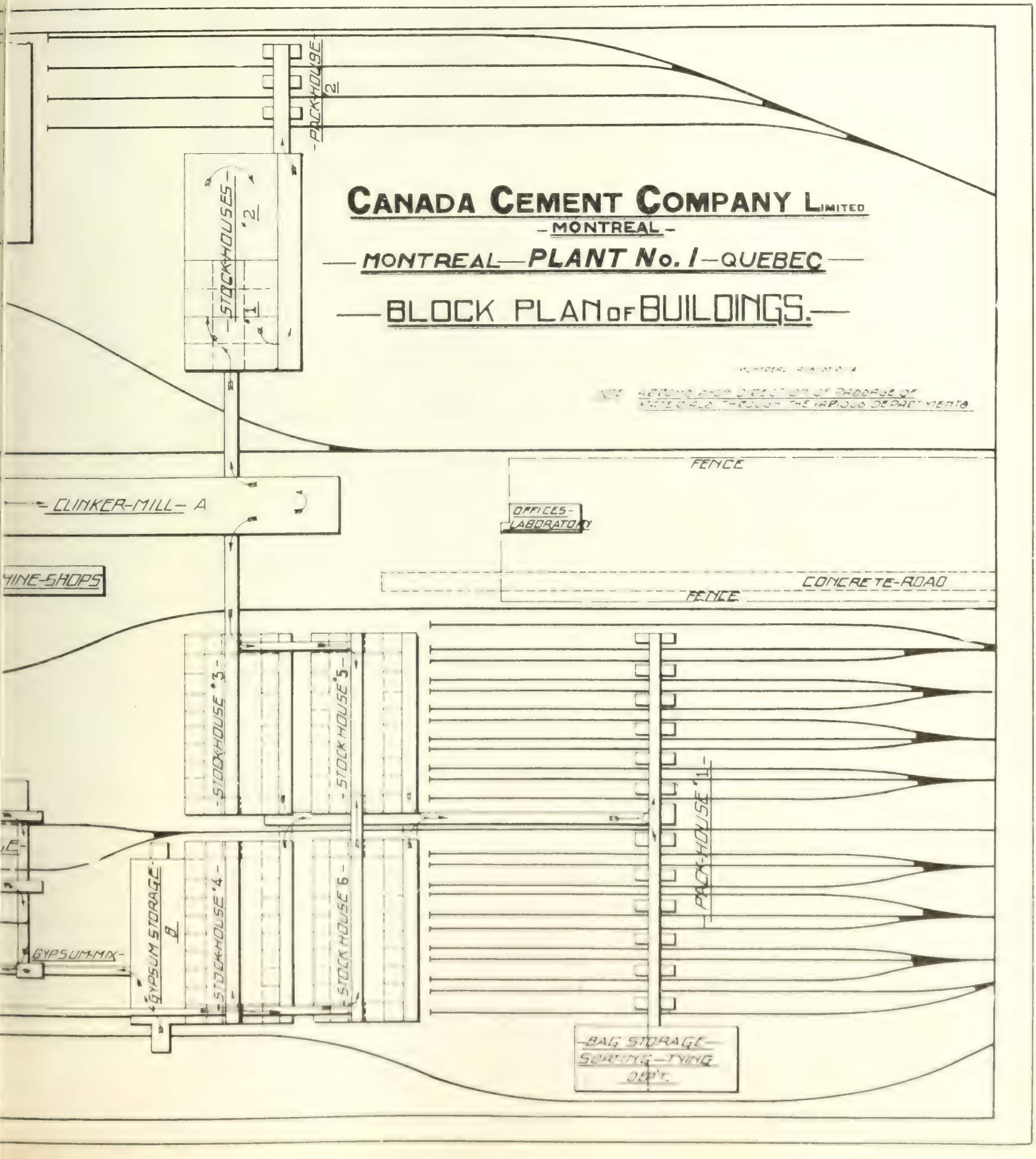


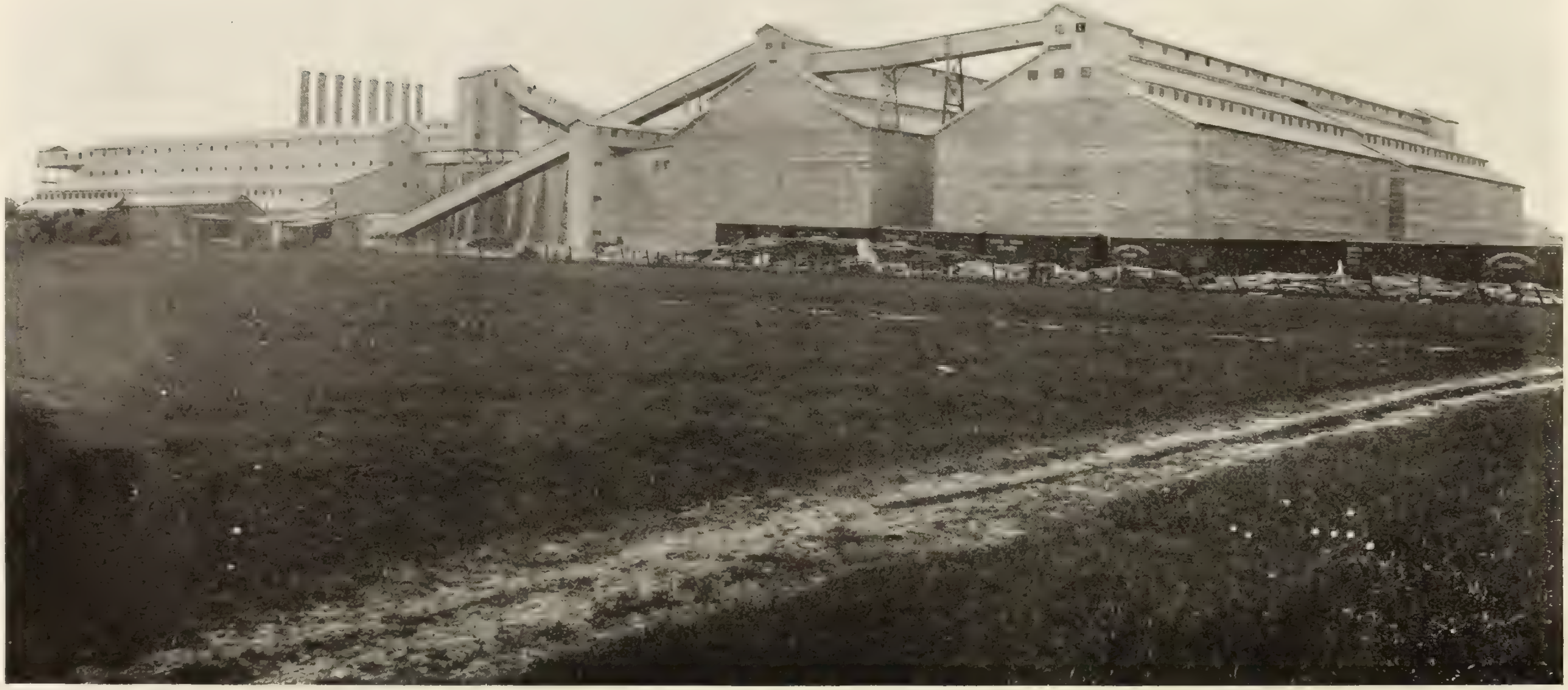
and by a transfer belt to No. 6. Both No. 3 and No. 6 can also transfer to No. 5 as an overflow from either "Mill A" or "Mill B."

Pack Houses.—The consideration of having to ship somewhat more than double the daily production, during certain periods of the summer season, requires an abnormal packing equipment. The present arrangement allows for the installing of twenty-four Bates machines in Pack House No. 1 and six in No. 2.

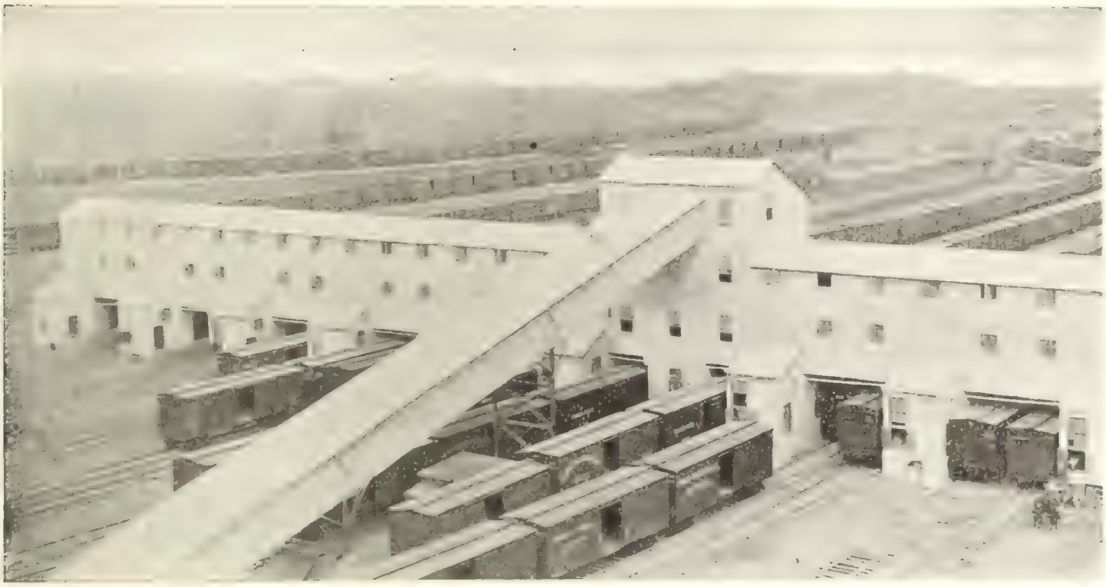
Pack House No. 1 draws cement from Stock Houses Nos. 3, 4, 5 and 6. The discharge belts of these deliver to either of two 36-in. inclined belts leading to the distributing tower in the middle of the pack house. The cement from each belt is passed through a rotary screen and on to another 36-in. belt, at right angles, filling the bins of one-half of the building.

The building consists of a series of packing sections. Each section is separated from its neighbor





General view of Plant No. 1, showing Stock Houses Nos. 3 to 6 in the foreground.



Pack House No. 1 and loading tracks.

by two railroad tracks running through at right angles to the building, but the conveyor portion is continuous over the whole. A double bin, in each section, supplies two Bates machines. The filled bags need to be trucked only a few feet to reach the cars on either side. This permits of using one machine to either track, two machines to one track or one machine to two tracks, depending upon delays due to the shunting of cars or repairs to machines.

The conveyor bridge has two floors. The upper floor is for the conveyor and the lower, a through runway, is used for distributing bags to the machines without interfering with machine operation or the shunting of cars. Beneath the buildings is a screw conveyor, in a tunnel, gathering the drip from the packing machines. This runs from both sides to an elevator in the central distributing tower. Here it is mixed with the incoming cement and again passed through the screens.

Bag Cleaning and Storage.—The Bag Cleaning and Storage Building connects with the distributing runway of Pack House No. 1 at its southern end. One portion has two floors. The lower floor is for the counting and cleaning of returned bags and is equipped with four large bag rumblers. The upper floor is for repairing and tying. Tied bags are bound together in bundles of 100 and placed in the storage section, so as to be available for the machines at any time. This has a capacity of about 2,000,000 tied bags.

Pack House No. 2.—Pack House No. 2 draws cement from Stock Houses No. 1 and No. 2 and is similar in construction to Pack House No. 1, except that it has only one track between each section. It is used largely for shipments by street railway.

Grinding Department, "Mill A."—Returning to "Mill A," the raw grinding equipment consists of 16 Bonnot pulverizers. Clinker grinding is done by 14 ball mills, followed by 16 tube mills. The clinker

Coal Mill and Storage (during construction) storage has a capacity of 100,000 bbls. and is served by two bucket conveyors. These conveyors carry both the clinker and the gypsum to large overhead bins, from which they are drawn in the proper proportions into a small car. The car is then hauled by an electric hoist and is discharged into the bins over the ball mills.

Coal Department.—The Coal Mill is located northeast of the Kiln Building and connected with it by a screw conveyor, running over the line of coal tanks in front of the kilns. Its equipment consists of six indirect driers, two kominuters, and six 5 ft. x 10 ft. tube mills. Beyond it is a large open storage. Two gravity elevators receive the coal from a track hopper, delivering either to the dryer bin belt or to a belt in the bridge over the storage. This bridge is 500 ft. long. A similar belt, in a tunnel beneath, returns the coal to the elevators, which discharge it to the dryer bin belt.

Coal Unloading Dock.—The dock now under construction will be equipped with an electrically-operated coal unloading bridge over 400 ft. long, having a handling capacity of 200 tons per hour, and providing a storage for 200,000 tons. The same machinery will reclaim from storage and load into cars for haulage to the plant.

Laboratories and Shops.—Fully equipped laboratories occupy a portion of the Office Building, in which continuous tests are made of the raw materials and finished cement. The Stores are located just east of Clinker Storage "A." Adjoining them are the Machine Shop and Blacksmith Shop. These, together with the Carpenter Shop, make it possible to do all ordinary repair work promptly.

Cement In Lumber Dry-Kilns

Concrete Provides Efficient Insulation Against Radiation or Other Heat Losses, as Well as Against Entrance of Moisture

By G. D. Crain, Jr

WHEREVER tightness against both moisture and air is desired, the use of concrete has become practically a foregone conclusion in recent years. Conspicuous examples in proof of this are found in the use of reinforced concrete for the construction of grain bins and elevators and other such necessarily moisture-proof structures.

A somewhat inconspicuous, but nevertheless important, illustration of the same valuable properties of concrete is found in the use made of it in constructing the dry-kilns now generally employed in all of the larger establishments that must use lumber in their operations. These kilns, the purpose of which is to remove by artificial means the moisture from green lumber, should, of course, be perfectly tight, in order to secure the best results; and experience has shown designers of such structures, and wood users generally, that the liberal use of concrete is the best way to do this.

A dry-kiln built for a Louisville wagon manufacturing concern in 1906 is as interesting a piece of work as can be found. Its relatively long period of use is also of interest as demonstrating the efficiency and durability of the kiln.

This wagon company uses large quantities of lumber, principally oak and hickory; and inasmuch as it is highly desirable, if not essential, to keep the plan in practically uniform operation as much of the time as possible, a large and efficient dry-kiln was needed to make certain that there would always be on hand an ample supply of well-cured material. In certain seasons the natural supply of air-dried material is frequently very short; and as it takes about four years for a 4 by 4 stick of hardwood to season in the yard, the advantage of an efficient dry-kiln is obvious as a means of hastening operations.

The requirements of a dry-kiln being as indicated, the use of a material which would prevent the radiation or other loss of the heat introduced was obviously necessary; and for this purpose the contractor hit upon concrete in conjunction with hollow fireproof tile—a combination that eliminates the otherwise almost constant danger of fire in such structures.

A rather odd situation controlled the design of this dry-kiln as to the method of drying, which provides for the use of two distinct processes—one as steam radiation system, as used in the "Andrews" type of condenser kilns; and the other, a hot-air blast, this being known among lumbermen as the "common-sense" kiln. The company had not fully satisfied itself as to which method was most efficient, and therefore decided to make arrangements to use both.

The building measures 101 ft. long by 91 ft. 6 in. wide; and in order to enable the two systems to be used side by side, the yard track carrying the cars of lumber into the kiln was run between two separate sections, one of which contained the blast system, and the other the steam radiation system. The former consists of a series of six chambers of about equal width, but of only half the depth of a similar series on the other side, in which the steam is used.

In order to prevent moisture creeping in from below, or heat escaping in that direction, concrete floors are used throughout the building, a slab about 5 in. thick, with a 1-in, top coat, being used.

The two systems calling for different systems of placing the lumber, the construction plans of the two sides were also necessarily different. The most conspicuous difference, perhaps, lies in the height of the floors themselves. The tracks in the several chambers are necessarily higher than the track entering the building, the method of handling the lumber being to bring in a loaded truck from the yard, set sidewise on another truck, so that it can be rolled off onto the track in the chamber in which the lumber is to be dried. No turntable is necessary, the tracks in the drying chambers running at right angles to the track entering the building.

In the hot-blast side, the hot air being forced through the several chambers by a fan and suction system, which carries the air through at one side and back by the other, it is not desirable for the lumber to be much elevated; and the floor is therefore raised to the level at which the car must enter these chambers from the track from the yard. The concrete floor in this side of the building, therefore, rests upon a fill of cinders, which brings it up to the proper level.

On the other side of the building, however, the heat which effects the drying comes from 1-in. pipes running along the floor, and the lumber must be elevated above these. The floor proper, therefore, is flush with the floor on which the entering track runs, the tracks in the chambers on this side being supported on steel standards $3\frac{1}{2}$ inches in diameter, which in turn are bolted to concrete piers. The tracks on the other side rest on dwarf concrete walls 12 inches thick.

The walls dividing the several drying chambers are composed of 8-in. hollow tile, coated on each side with an inch thickness of a cement mixture. The roof is a rather curious, but wholly effective affair, made up of several distinct layers of different materials, the rising tendency of heated air making it especially necessary to provide against loss of heat at the top of the building.

Immediately above each chamber, constituting the inside ceiling finish, is a 2-in. thickness of a concrete mixture, applied as if it were plaster. The 4-in. thickness above this, constituting the roof structure proper, is of the ordinary floor-plan used in many buildings, consisting of a series of ribs or beams, the spaces between these being filled with hollow tile. These beams run at right angles to the walls, and derive part of their support from them.

On top of this roof-slab of concrete and tile, a thick layer of cinders is used, ranging from about 6 in. at the edge to twice that, according to the pitch of the roof. This in turn is covered with composition roofing, making a quadruplicate roof which has proved very efficient in keeping the heat in the building.

Patented doors and door-hangers are used at the entrances of the building, as well as to the several chambers, set in concrete frames to prevent the outside temperature from affecting the drying process. The careful separation of the drying chambers from the passage on which the entering track runs is particularly necessary, in view of the fact that this passage is lighted from above by means of skylights, and it is difficult so to adjust ordinary skylights so as to make them air-tight. In this case, accordingly, the lights rest on concrete frames.

Heat for the hot-blast sections, and steam for the other side of the drying plant, are furnished by the power plant of the company, which is only about 100 feet distant. Both are conveyed overhead by means of asbestos-covered pipes. Exhaust steam is used during the day, live steam being provided at night when there is any lumber drying.

The dry-kiln has proved completely satisfactory to the company, handling very efficiently all of the lumber which has to be dried; and, it may be remarked, the company has not yet fully decided which drying system it prefers.—Cement World.

In connection with the walls of a brick building it was desired to clean and brighten the terra cotta trimming, the brick being of a deep tan color, while the terra cotta was of a light cream that had turned dark and was unsightly from many years' exposure. In answer to this question by a correspondent of the Painters Magazine, the latter furnishes the following: The simplest way to accomplish this is to mix two pounds of powdered pumice and one pint of liquid ammonia with one gallon of soft soap, applying the mixture to the surface to be cleaned with a fibre wall brush, allowing it to remain about thirty minutes. Then rub briskly with a good scrubbing brush. When on trial it shows that the compound has done its work, clean it off with lukewarm water by using a large sponge and rinse, if possible, with a hose, otherwise with the sponge and a liberal supply of clear water. If after drying the terra cotta appears dull, it may be revived by rubbing it over with a cloth saturated with kerosene oil, which will give it somewhat of a "sheen."

Unprecedented Trussed Spans

DESIGNS and estimates for a $75,000,000 high level bridge across San Francisco Bay have been prepared by Charles E. Fowler, according to the Engineering Record. They include terminal structures at both ends, a 20,000-ft. approach and 800-ft. cantilever spans at one end and a 9,700-ft. five-span $49,000,000 crossing from Telegraph Hill to Goat Island. The important features outlined in the general design presented include beside the unprecedented dimensions, the general outlines of the trusses, the character of the sub-structure and the details of main pedestals and compression chords for the cantilever arms.

The bridge is designed for a capacity of 60,000,000 people and 56,000,000 tons of freight annually, and is proportioned for two steam railway tracks, two electric car tracks, and two 20-ft. roadways giving an assumed loading at 18,000 lbs. per linear foot. The cantilever structure, symmetrical about the centre point, has a clearance of 150 ft. above high tide and has three 2,000-ft. spans, four 250-ft. intermediate towers and two 1,350-ft. shore spans. The main spans have 650-ft. cantilever arms and 700-ft. suspended trusses, while the end spans have 650-ft. cantilever arms and 700-ft. trusses connected to them at one end and supported on the abutments at the other end. The depth of the trusses vary from 75 to 450 ft. and the horizontal distance between them varies from 65 ft. in the clear at the centre to 126 ft. at the towers. The trusses have 100-ft. panels with single diagonals and curved top and bottom chords.

The cantilever bottom chords are octagonal tubes 14 ft. in outside diameter made up of eight sets of three built I-beams 18 ins. deep with outside and inside flange cover plates forming the interior and exterior surfaces of the tubes. They are stiffened by solid web transverse diaphragms reinforced by heavy vertical horizontal and flange angles. A typical section is built up of $1\frac{3}{4}$ x 70, $1\frac{3}{4}$ x 54, $1\frac{1}{2}$ x 50, 1 x 26, $1\frac{1}{2}$ x 21 and 1 x 18-in. plates, and ninety-six 6 x 6 x $\frac{3}{4}$-in. flange angles, giving a total cross-sectional area of 3,602 sq. ins.

Each of the four vertical posts of each tower will have a built up shoe planed to a long radius bearing to provide adjustment for deflections in the span. Nickel steel will be used for the suspended spans and for long tension members in the cantilever arms. The concrete piers with very deep foundations will be frustrums of cones providing extended footings to secure sufficient bearing and having granite tops 35 ft. high to distribute the loads over the concrete. It is assumed that the bridge will be completed in about ten years.

Proper provision should be made in concrete construction for temperature changes either by reinforcement or by expansion joints.

Permissible Pollution in Raw Water to be Filtered for Domestic Consumption[*]

By Geo. W. Fuller, New York City

WHILE for some years this question of the proper loading or burden on filters has been considered in many places and attempts have been made to fix some sort of a standard which would serve the purpose, these attempts have met with very little success. The difficulties of fixing such a standard are self-evident. It is rather obvious that no exact relationship exists between the sanitary quality of the water and the number of bacteria present, no matter how the bacteria are tested, whether in the form of total bacteria or some special form such as the colon bacillus. It is possible that some waters should have good sanitary properties and yet have a rather large number of bacteria. Other waters, again, which might be relatively free from bacteria, would show themselves to be unhealthful.

While it has been clearly recognized that some limits, definite if possible, should be placed on the proper burden for filter plants, no such limit has, until recent times, been established.

B. Coli as a Basis of Determination

The first question that arises for determination is, How shall the quality of a water be measured or determined? For bacterial purposes, bacteria have been taken in various ways, measuring the total number of bacteria either at 20 deg. Centigrade or 37 deg. Centigrade on various media. Then, again, special bacteria, such as the B. coli, may be considered a better indication of the fecal pollution than total bacteria. In some extreme cases experiments have suggested the taking of the actual determination of disease bacteria, such as the typhoid bacillus or the cholera bacillus, as a guide to the true disease-carrying sources of pollution. Each of these methods has some advantages and some disadvantages.

Considering the last, the direct determination of disease-producing bacteria, this is practically ruled out by the difficulty of making such determinations. It has not yet been generally feasible to determine with precision and certainty whether bacteria such as the typhoid are present in any water, and while such determination is sometimes successful it has not been generally so. In addition, we are not quite sure as to the limitations of water-borne diseases to any specific small number of kinds, and it would be quite possible that even exact and positive exclusion of a certain small number of organisms would not be a guarantee that the water could not contain some other disease-producing bacillus which has not yet definitely been determined as such.

The determination of the total number of bacteria present has been the simplest and most common form of water analysis procedure, and has considerable value. The old standard of the German sanitarians was an allowance of 100 bacteria per cubic centimeter in filtered water. This standard is a simple and in some ways a useful one, and has been widely extended in this country. Assuming a bacterial efficiency of the filters at 98 per cent., the raw water to give such a filtered water should not exceed a bacterial content of 5,000 per cubic centimeter.

The objection may be raised that by far the greater number of bacteria are simply water bacteria or non-pathogenic, and are no indication either of pollution or of having any harmful effect. A water may have a very large number of bacteria and still be absolutely harmless. This objection has been strong enough largely to discredit the total number of bacteria as being a very good evidence of the wholesomeness or unwholesomeness of any particular water.

The third determination, that of B. coli, has come to be recognized as the most satisfactory, all things considered, of the possible methods of determining the pollution of a water. B. coli of itself is not, of course, any direct indicator of disease-bearing bacilli. It is only a very indirect evidence of the possibility of recent fecal pollution. As is well known, B. coli originates from many other sources than human fecal excrement. It is found in large quantities in animals, particularly domestic animals. It is also found in considerable quantities on grain materials and tilled fields. Water running off from farms, pastures, etc., must necessarily contain considerable quantities of such coli, and under such circumstances B. coli in no way show the evidence of dangerous pollution. Nevertheless, taking everything into account and knowing the limitations of the B. coli as an indicator of fecal pollution, it still must be said that this is the single best means we have of determining whether a water is most probably wholesome or unwholesome according to a number of B. coli present in the water. We recognize that this basis of determination is not at all conclusive or positive, but we also recognize that it is the best we have, and as such it is proper to make use of it in gauging the sanitary qualities of the water.

U. S. and Canadian Investigations

An International Joint Commission, composed in part of appointees of the United States and in part of appointees of Canada, has been investigating the question of pollution of the international boundary waters, with the idea of determining to what extent pollution must be limited in order not to endanger the health of the communities on the two sides of these boundary waters. As a great part, if not all, of the possible danger to health which must arise from drinking water, the question practically resolves itself into this:

Is it possible to maintain the water in such shape that without treatment it shall be suitable for drinking water?

2. If it is not possible to maintain the water in such a condition of purity and it does need filtration before being suitable for drinking water, what is the limit of pollution allowable before the filtration plant will be overloaded, and safe drinking water cannot reasonably be obtained by ordinary filtration?

The first source of information is those cities which have been receiving a supply of unfiltered water which have sufficient data available to show how this water stands in rank on the basis of B. coli present in the water. An examination of these B.

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[*] From a paper presented at the recent annual convention of the American Society of Municipal Improvements.

coli records and the records of the city, its typhoid data, to show whether this water can reasonably be classed as a fairly healthful and wholesome water or whether it should be classed as a water of rather deficient quality. A second source of information is the various filtered waters which are supplied to a number of communities and the records they have of coli content in this filtered water and the B. coli content in the raw water supplied to those filters. Most of our communities which do have filtered water show a satisfactory effluent and a satisfactory typhoid fever rate, which is some measure of the wholesomeness of the water supplied. An examination of the correspondingly raw waters applied to the filters gives some indication of where a reasonable standard limit should be placed. A third source of information is the consideration of a standard of efficiency of bacterial removal and the assumption of a reasonable number of B. coli in water supplied for drinking purposes and a corresponding calculation of what would be a proper natural limit of B. coli in the water supplied to the filters under these conditions.

On the basis of the information of these three classes must be fixed the required standard. This information, which is afforded, is by no means exact in character, and no exact reading can be made from it even in any particular case. Moreover, the data obtained from various cities are very conflicting, and even the data obtained at various times from the same cities under apparently similar conditions are conflicting and cannot always be reconciled. Some cities are receiving a markedly poor water in B. coli content, yet have a very satisfactory water from a sanitary standpoint, and typhoid fever rates are relatively low. Others, again, receive a rather good water and deliver for drinking purposes a decidedly good water and yet show a much less satisfactory typhoid fever rate.

It is recognized that typhoid fever originates only in part in water supplies, and that B. coli in the water and typhoid fever rates need not be in any relation to each other.

A case in point is that of the Birmingham, Ala., water supply. This city receives its water from two sources, namely, the Five-Mile Creek and the Cahaba River. The water from the Five-Mile Creek is sterilized after being filtered and shows practically no B. coli as delivered to the consumer. The water from the Cahaba River is filtered but not sterilized, and shows an appreciable amount of B. coli as delivered to the consumer. The water from the Cahaba River is filtered but not sterilized, and shows an appreciable amount of B. coli, though not an extraordinary number. Yet the typhoid fever of the two districts supplied from the two plants is no better in the first case than in the second. In the entire city the typhoid death rate is very low during the winter months but is high during the warmer season of the year, when fly transmission becomes a factor of importance.

The best that can be done with the data at hand is to consider all these data, properly weigh them, and on the basis of a rather general judgment come to some conclusion on what is a proper limit of B. coli in water to be applied to the filters. Such a conclusion can by no means be considered an exact judgment, and should be considered rather an average than a rigid limit for any particular case. This standard specifies that water applied to filters should show by the presumptive test not more than 500 B. coli per 100 c. c. of water as a yearly average, meaning by this that B. coli should not be found more than fifty per cent. of the time in 0.10 c. c. samples. For averages for shorter selected times, monthly, weekly, or daily, the allowable B. coli content may be considerably higher. It is believed that for this purpose the averages based on a year's readings are more useful than averages for a shorter time with a correspondingly different standard of allowable B. coli.

The adoption of a standard such as this means that, apart from pollution objectionable in other ways than bacterial, the allowable limit of bacterial pollution should be particularly measured by the condition of the water as it reaches the intake of some water supply where the water is purified. If this water shows no more than fifty per cent. positive tests for B. coli in 0.10 c. c. samples as a yearly average, the amount of bacterial pollution arising from a sewer outlet may be considered not too high. If, on the other hand, the bacterial standard so set is exceeded in the water supply, the need is set for the polluting community to purify its sewage by sterilization or further to such an extent that the water will not be affected to a more objectionable degree than the one allowed.

Local Conditions to be Studied Carefully

For any particular case to be considered special consideration must be given to the local conditions. If the water is such that practically all the B. coli can be attributed to sewage pollution, a rigid interpretation of the standard would properly be in order. In the case of a stream passing through farming communities where a large part of the B. coli does not originate directly from fecal excrement, but from fields, under such conditions that disease pollution would not follow, this standard can be more liberally applied. Other factors to be considered are the distance of the water supply intake from the source of pollution, the degree of dilution of the sewage effluent, the nature of wind and water currents, which may objectionably or favorably affect the movement of water to a water supply intake, and many other factors of this nature. While it is undoubted that a good deal of judgment must be used in special cases in applying any special standard of purity, and while such a standard cannot be used in ignorant hands as a substitute for expert supervision and expert judgment, a basis such as this is well worth establishing as a starting point for further investigations.

The bacterial efficiency of a filter is not an invariable quantity. Roughly speaking, 98 to 99 per cent. may be placed as a fair average under ordinary conditions. Percentages, however, are not always a good gauge of efficiency, as a water with an initial bacterial content that is high will show a proportionately higher efficiency in a filter than a water with a low bacterial content, and yet the resultant filtered water may be much less satisfactory to the consumer from a healthful standpoint than would be the case with the other filter with a lower bacterial efficiency.

With these conditions in mind, it seems reasonably safe to say that a water having in its raw form a coli content not exceeding 500 per each 100 c. c. based on yearly averages, will show in the water supplied to the consumer something not more than [illegible] B. coli per 100 c. c. Such water is believed to be a fairly safe water, when properly sterilized, for drinking purposes and for all other domestic uses.

Bituminous Surfaces for Concrete Roads

By W. H. Fulweiler in Concrete-Cement Age

THERE are three points which must be taken into consideration in order to secure satisfactory results. These refer to the condition of the concrete, the character of the bituminous material used and the method of application.

With reference to the condition of the concrete, many of the failures which have been attributed to the bituminous material have, in fact, been due to the formation of the thin film on the surface of the concrete of what I believe is now agreed to be a pectoid of the colloidal calcium silicates, which are formed by excessive trowelling or working of the wet mixture. This material does not adhere strongly to the concrete and it is readily broken off under the action of the traffic, so that the bituminous topping or surface when it rapidly peels away will be found coated on the under side and still in perfect adhesion to the thin white film which was the original surface of the concrete.

In order to avoid this, wherever we are in a position to control the laying of the material, we insist that the concrete shall be handled as little as possible, and we strongly deprecate trowelling and smoothing to obtain an even surface. We prefer that the concrete shall be simply struck off with a template, and further to prevent the formation of this "skin coat" we specify that just as soon as the concrete has taken its initial set, it shall be vigorously brushed with a stiff rattan or steel broom in order to break up any surface film.

With reference to the character of the bituminous materials, it will be appreciated that two qualities are essential:

First, that the material shall adhere perfectly to the concrete.

Second, that it shall possess sufficient binding qualities so that the bituminous concrete, if we may so call it, that is formed by its admixture with the stone chips shall possess sufficient cohesion to resist displacement by the traffic.

These two qualities may seem contradictory. The earlier experiments were made with material having a body or viscosity that was in the nature of a compromise, being in fact too heavy to secure this necessary adhesion and too light to possess the necessary binding qualities.

This has led us to the use of two treatments, using different materials.

The first treatment consists of a very light application of a very thin material prepared by cutting back a heavy binder with a volatile distillate. This is, in fact, in the nature of a varnish. Since it possesses great fluidity, it penetrates the thin film of dust which always exists on the surface of concrete and in fact actually penetrates the surface of the concrete itself, to a depth of at least 1-16-in., the depth of such penetration varying with the character of the mixture and the handling it has received.

After exposure for about two hours the volatile cutback evaporates, leaving the heavy binder intimately incorporated with the upper surface of the road. In this manner perfect adhesion is secured.

We then cover this coat with our heavy binder, which possesses the necessary binding qualities to the fullest extent, since these do not have to be sacrificed to secure adhesion. In this way, we believe that we secure maximum efficiency.

In connection with the method of application, we believe that it is essential that the greatest care be used to sweep the surface of the concrete thoroughly, and remove all loose particles of stone, dust, etc., and especially exercise care in cleaning the depressions that inevitably occur in large surfaces, and are very difficult to sweep thoroughly, unless especial attention is given to them.

We apply the material from motor-driven pressure distributors, the pressure used being about 50 lbs. per sq. in.

To insure that the preliminary cold application should thoroughly penetrate the surface of the concrete, we are now recommending brooming this into the surface after its application with a power broom carried behind the distributor. By the use of such pressure distribution the balance of dust existing on the surface of the concrete is blown to one side, and the bituminous material comes into actual, physical contact with the concrete.

With reference to the mineral aggregate composing the bituminous surface, we have not sufficient data, as yet, to decide whether or not a thin coating applied at more frequent intervals would be more economical than a thick coating applied in the first instance and maintained with more or less frequent re-treatments.

We believe, however, that where there is very heavy traffic the thick coating will be found considerably more economical.

In explanation of the terms "thin coating" and "thick coating," I may briefly explain our specifications.

In "thin coating" the surface of the concrete is thoroughly swept, and 1-10. gal. per sq. yd. of our Ugite A is applied and broomed into the surface. This treatment is allowed to stand for about two hours, and 4-10 gal. per sq. yd. of our Ugite No. 3 is then applied at a temperature of 250 deg. F. and covered with from 35 lbs. to 40 lbs. of clean ½-in. stone chips per sq. yd., or clean, screened gravel of equivalent size.

For the heavy treatment or "thick coating," after the application of the 1-10 gal. per sq. yd. of our Ugite A, we apply 1-3 gal. per sq. yd. of the Ugite No. 3, and cover it with 40 lbs. per sq. yd. of stone chips, ¾-in. size.

A second application of 1-3 gal. per sq. yd. of the Ugite No. 3 is made, and covered with 30 lbs. to 35 lbs. of the clean ½-in. stone chips per sq. yd., or equivalent size of clean, screened gravel.

We believe that by the use of the ¾-in. stone we secure such an increase in the stability of the surface that it is not liable to displacement under traffic, especially the influence of heavy steel-tired vehicles.

Repairs on the natural cement floors of the 12,000,000-gal. storage reservoirs at Kansas City during 1913 were made necessary on account of the breaking through from one reservoir to the next under the walls. According to the latest annual report of Burton Lowther, chief engineer of the Water Department, the condition was obviated by driving 10-ft. steel sheet piling as a cut-off wall along the toe of the division wall. A 6-in. concrete floor was then placed over the entire floor and the heads of the piles were sealed over with a heavy slab of concrete made continuous with the floor. All slopes were repaired and cracks grouted. The work was carried on night and day by three shifts of fifty men, each working eight hours.

Liquids Used in Paints

By A. Ashmun Kelly

THE first in importance is linseed oil, for no other oil that may be used in paint commercially possesses as high a degree of excellence as this one. A paint film of this oil will not check, crack or blister after being applied, if properly applied to a proper surface. The oil flows well under the brush, spreads well, has enough body to hold up any ordinary pigment, and it does not run or become streaky. No other oil that may be used in common paint, that is to say, in paint used for structural work, will show these advantages. In brief, linseed oil is as nearly ideal for the purpose as seems possible. It has its defects of course. A few other oils have been used to take the place of linseed oil in paint, such as cotton seed oil, a very poor substitute, for it is not a drying oil; a very little of it in paint will show its character. Corn oil was some years ago used to some extent for putty making, and some of it got into paint, but it too is a poor drier, and at present its price takes it out of the class of linseed oil rivals. Soya bean oil is a semi-drying oil, and may be used in connection with linseed oil, but used by itself in paint it will not do, as it is another poor drier, not making as tough a film as linseed oil. Both poppy seed and hemp seed oil would do well as house paint oils, but their price is prohibitive. Paint mixed with poppy seed oil will not turn yellow in the dark as paint mixed with linseed oil does. Menhaden fish oil is an interesting oil to the painter; it will stand a great degree of heat, hence is useful in stack and boiler painting. It dries about the same as linseed oil, and produces a hard, waterproof film. China Wood Oil or Tung Oil is another oil of interest to painters, and it possesses some very curious characteristics. It dries very hard. It naturally dries very lustreless, which renders it useful in paints or in varnishes where a flat effect is desirable. The addition of as little as ten per cent. of rosin gives it a high gloss. While linseed oil dries from the surface, Tung oil dries uniformly throughout, and it is also the most rapid drying of all the drying oils. It is thicker than linseed oil, and is waterproof. It has no use in the paint shop, but the varnish maker can use it to good advantage.

Oils may be divided or classified according to their drying properties as follows, giving the principal oils of each class:

Drying Oils.—Linseed, walnut, tung, poppy, sunflower.

Semi-drying Oils.—Rape, fish, cotton, hemp, sesame, soya bean, maize or corn.

Non-drying Oils.—Olive, palm, castor, almond, cod liver.

Turpentine spirits made from the gum is the most important thinner next to linseed oil. While it thins oil paint perfectly it does not make it "short," it resists drying, prevents wrinkling, reduces the tendency of paint to become fatty, works well over damp wood, for it will absorb a certain amount of water. It is not affected by cold, withstanding a temperature of 30 deg. Fahr. without danger. It mixes readily with all paint oils and thinners, and may be mixed cold to any of the oil varnishes without causing separation of the gum. It is particularly liked for its flatting properties. Thin oil paint with benzine, and when the benzine evaporates the paint will have more or less gloss. Not so with turpentine. But it contains a certain acid that affects certain pigments, such as flake white and rose madder, changing their color within 24 hours after mixing. Turpentine made from stumps, etc., has the same qualities as pure gum turpentine, but the odor is different. Turpentine substitutes are made mostly from petroleum distillates. One of these distillates is water-white and is something between benzine and kerosene oil, but does not leave as much grease on white paper (a test) as kerosene does. While in most respects it is better than benzine for paints, yet it does retard drying somewhat.

Most turpentine substitutes are made from foreign petroleum oil, the American oil, while the best for illuminating oils is too light to make a good turpentine substitute. Russian "turpentines" are very greasy and do not evaporate well. It is truly remarkable how much like true turpentine spirit these substitutes smell, but this is explained by the fact that wood turpentine is added to give it that odor.

Benzine is a very active thinner of paint, and a great solvent of oils, but it possesses none of the best qualities of turpentine; it cannot take its place in painting. For instance, it acts too actively on the oil, removing too much of it, thus leaving the pigment with insufficient binder. It makes a paint short of grain, it does not level well nor give a good flat under the brush. It makes a soft paint. White paint thinned with it will yellow, which is not the case with turpentine. It does not work well in paint over damp wood. It will not mix with water.

Kerosene or coal oil, the former distilled from oil taken from the earth, the latter from coal, yet identical, is not a little used in painting. It mixes easily with oil paint, and painters like it for its easy flow and elasticity, and it is very repellant of water; but it is a very poor drier, not a self-drier at all, and only made to dry by the addition of considerable manganese driers. It is most used in the South and on the Pacific coast. In California it is used to almost the exclusion of turpentine. As far as my own experiments have gone, it is entirely unfit to use in structural painting.

Water is sometimes used in paint, both as a thinner and as an emulsifier. Water will not mix with oil unless in the presence of an alkali, or glycerine, or alcohol. Oil and alkali form a soap, oil and glycerine form a glyceride, while oil and alcohol form a mechanical mixture.—National Builder.

At a special general meeting of the Vancouver Builders' Exchange a committee was appointed for the purpose of making arrangements to co-operate with similar committees from other business associations in the city with a view to considering the question of trade conditions generally and the financial situation in particular. Mr. Hamilton-Lindsay, the secretary, states that manufacturers of material in the province have considerably reduced their prices. He suggested that the Dominion Premier should be approached on the question of the present need for a change in the financial system of the country. The committee of the exchange are of opinion that it is high time the Government took a hand in the banking question instead of leaving it to the banks, as the Finance Minister had done. For some reason, it is held, the banks, instead of taking advantage of the offer of the Government, are apparently doing their utmost to strangle all legitimate business, in this section of the country, at any rate. Mr. Hamilton-Lindsay also states that the committee is of opinion that the National Association of Builders' Exchanges should take up this question with the Government.

"Going After" Business the Only Way to Get It

The Present is no Time to Rest on One's Oars—Business Lost Now will be Hard to Regain—Customers Gained Now will be Doubly Valuable When Trade Revives

By A. A. Briggs[*]

[Editorial note—In view of the fact that the Dunlop Tire & Rubber Goods Company, Limited, have decided to increase their advertising appropriation at the present time, this summary of conditions which influence national advertisers in making such a decision, will undoubtedly be read with great interest.]

Retrench—"To lessen, to abridge, to curtail"—that's what the dictionary especially calls it.

But hasn't the war so far shown that to retrench means particularly to **dig out a fresh trench,** to secure the means and the assistance to make a new assault on the enemy? In the latter interpretation we undoubtedly find what ought to be the keynote for the present advertising situation in Canada.

The truth is that on one side of the Dominion are ranged people who are following the dictionary's main stipulation of "retrench" for their publicity guidance. They may have reasons for so doing which no one in a different line of production can justly pass an opinion on; but it is also true that on the other side are ranged people who are leading—not following anything or anybody in their advertising policy which does not at once spell **Action.** It cannot be denied that the people who have decided "to lessen, to abridge, to curtail" their publicity are in the ascendancy at the present time. And everywhere the reason advanced is: "The War."

So far, from the standpoint of salesmanship, **no one has adduced a solitary economic reason why Canadian manufacturers who inaugurate advertising campaigns as a regular portion of their selling effort should discontinue that programme at the present time.** And, is it not strange that in all our mental hurrying to and fro, no one has yet proclaimed the fact that the war did not alter the Canadian consumer-purchasing market one iota? It must be understood that in making the above statement we are not dealing with any isolated cases where this particular business or that particular business may have been affected in countless ways other than the selling end. It is true, a manufacturer may have to pay more for his raw materials as one result of the war, but if he can get the materials at all, he always has the instrument of retail price-increase to wield in offsetting his losses, if necessary.

What really did alter the possibilities of the consumer purchasing field in Canada? Not the war, but the lull that antedated the war. A number of reasons precipitated the lull—most of which the public are conversant with. In other words; dull times, if one chooses to call them such, were here anyway—here in the sense that while the consumer was willing to a considerable extent to make purchases, the middleman had in many cases gone rather askew in his financing. The war simply accentuated the fast-spreading inclination to sit tight.

Naturally, during a portion of 1913 and most of 1914, manufacturers, in the main, were conservative in the matter of building extensions and such like, and sales efforts were always linked to due caution. This year, probably more than usual, attention was centred on the outcome of the Western wheat crop. That crop virtually has arrived, and, if reports are true, it is a good deal larger than advance estimates intimated. Then, notice the price per bushel paid for some wheat at the elevators. The farmers should now assist basic money circulation, which, of course, always commences the upward trend in the retail line.

In seeking out forces for advertising stimulus, it is one thing to deal with the possibilities of new fields of endeavor for Canadian manufacturers and another thing to explain away the measure of uncertainties attached to them. It cannot be gainsayed that consideration of new fields may mean consideration of bonuses and tariffs. What ought to be emphasized is that the Canadian manufacturer has, at least, as much area market as he had previous to the war and the general lull in consumer-buying conditions. Therefore, instead of risking new fields, which at best may be a costly experiment, the natural course seems to be that of again seeking the old field—**but seeking it ten times more forcibly.** This fact is brought home to us with double force when we have evidence aplenty that our friends to the South, in the widespread revival of the export propaganda, are considering the commercial blanketing in this country. It, therefore, behooves the Canadian manufacturer who has advertised in the past, not only to advertise again to create consumer demand for his wares, but to advertise as a means of actually holding what he already has. While suggestions are being made to flank some of the European countries' export business to Canada, we should not allow ourselves to be flanked in a commercial sense by our neighbors across the line.

Those advertising men who passed through the trade siege of 1907 and others before it—which sieges or lulls, or whatever you wish to call them, some bankers say cast their sly glances our way approximately every seven years—know well that **the manufacturers who assumed the defensive in publicity matters on those occasions had a difficult time regaining their stride when normal times returned.** That is natural law in the commercial world. There is no profit in manufacturing, no excuse for a factory's existence, unless the selling end is vigorous. The energy which keeps the selling end vigorous in abnormal times is identically the same energy which keeps it vigorous in normal times—only it is in abnormal times that keeping up the stride is fraught with more discouragements. One hundred courageous manufacturers and five hundred patriotic purchasing agents are worth more to Canada at the present moment than a million sermons or editorials on humaneness in war.

Realizing that one of the big sticks in the commencement of Canada's Comeback is to be wielded by the purchasing agent, every man occupying such a position in Canada, should have a creed something to this effect hung over his desk where he who runs in for an order may read:—

"I have hitched the firm's wagon to the Made-in-Canada star.

"I will specify on all purchases that Canadian materials must be used or the order will be subject to cancellation.

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[*] Advertising Manager Dunlop Tire & Rubber Goods Co., Limited.

"I know in so doing that I will thereby be encouraging the other fellow—whose traveller calls on me—to buy my firm's goods and possibly at a higher price, too, than he would have to pay for the foreign article."

Let us be assured that Canadian purchasing agents as a body have lined up behind the Made-in-Canada slogan, and we can expect to see Canadian advertising manufacturers assume the offensive. They will know that if they can secure a portion of the trade which formerly went out of the country, they can afford to write off certain business, the loss of which was consequent on a measure of consumer retrenchment. And let consumers see with their own eyes manufacturers' copy running in the papers and those self-same consumers—assured that the factory in which they are employed is going to keep running or the copy wouldn't be running—will commence again to make purchases with some measure of freedom.

Canadian manufacturers as a body must of necessity exist on Canadian orders; to the great majority "export" is an unused word. Orders will not be secured in dull times by methods that would fail in good times. One of the established beliefs of merchandizing is that properly-placed and properly-managed advertising is a force for facilitating sales. If this were not true, why would certain manufacturers—sixty per cent. of whose output might be styled luxuries—increase rather than decrease their advertising at this very moment?

They realize they have a big job on hand—that of securing orders when orders are unusually hard to secure. And they know full well that following the simple instinct of **going after business is the only solution** to the problem.

Considerations for the Designing Engineer

QUANTITY production is the basis upon which our tremendous manufacturing industry rests. The principle is so well understood that those who seek to increase the efficiency of plants generally start by attempting to reduce the number of models and designs. From the standpoint of costs the ideal plant is one in which only one device is produced and only one model and one size of that device. Sales considerations make this ideal impossible of attainment. Nevertheless, it is a cardinal tenet of economical manufacturing.

To some extent the principle is appreciated by designers and constructors of civil engineering works. They know, for example, that the cost of standard supplies is less than that of specials, and experienced men accordingly call for stock sizes whenever possible. This is chiefly true of steel shapes, sewer pipe and water pipe and fittings. When more complicated structures are involved the designers generally forget the principle and design "de novo."

For these structures there are no well recognized standards, and in designing these engineers are frequently guilty of the grossest extravagance. Ignorant or neglectful of construction considerations, they demand work of the most expensive sort, even when a certain amount of standardization, dispensing with individual designs for each particular case, would make their own work easier. It is impossible to account for the lack of such standards in any other ways than carelessness and ignorance of construction methods, or belief that the field man is trying to influence the designer improperly. Sometimes in his cock-suredness he takes the position that the king can do no wrong, he, of course, being the king.

It may be thought that these are idle generalizations, but every contractor can cite cases in which even the tyro in construction could have saved 10 per cent. of the cost of the job without any injury whatsoever to the structure. Two instances will show how, even on important work, there are losses, easily avoidable, because standardization and quantity production were not given adequate consideration.

The first is the case of a $100,000,000 project involving a large number of bridge structures. While the spans and loadings varied but little, there might be found on a single 5-mile contract six different designs of masonry. Piers and abutments, it is true, varied in height and sometimes, on account of the material encountered, in the footings. In practically no case was any part of the forms for one set of abutments and piers usable on another. It is conceivable that with similarity of span and loading it would have been possible to make at least the upper ends of all piers and abutments identical.

In another case, in the reconstruction of a large terminal, a tremendous number of concrete jack-arches were employed, being sprung between pairs of deep I-beams. Here would have been an excellent opportunity for standardization in spacing, making it possible to reuse time and again the forms for supporting the concrete. Instead, all sorts of variations were found, making it impossible to reuse the forms except in rare instances.

In both cases the total represented by the construction was very large and the opportunity for duplication correspondingly great. Nevertheless, it was apparent that the designers had little regard for construction considerations, and placed the theoretical above everything else.

Another instance, in which, however, it was possible to rectify the ignorance of the designer before serious damage was done, occurred on a drainage project in the Middle West. The original estimate for the cost of the work was about $550,000. Upon the completion of the design the owners called in consulting engineers and the latter saw immediately that the plant available for the construction of the ditches in question had not been in the mind of the designer. By relaying out the project so as to make it possible to use to best advantage the most economical type of equipment the cost was reduced 37½ per cent.

Primarily, of course, the designing engineers are responsible for this condition of affairs, but ultimately the blame must lie with the chief engineer or other official in charge of the engineering work. It is his business to see that the designers fully appreciate construction considerations and bear them constantly in mind.—Engineering Record.

A uniformly dense mixture of concrete should be the primary expedient to secure water-tight concrete. This may be supplemented by mixing with the concrete some form of waterproofing compound of proved efficiency or by washing the concrete surface therewith, or by both. Care must be taken in the selection of the waterproofing material and in determining the proper proportions and methods of application.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

At Saanich, B.C., the ratepayers have carried a by-law to raise $375,000 for the installation of a waterworks system.

The Montreal City Council have appropriated the sum of $100,000 for the construction of water mains this season.

The extension of Wilton Avenue, Toronto, is recommended, at a cost of $622,000. The recommendation is that of Mr. R. C. Harris, Works Commissioner.

The Ottawa City Council have authorized the City Engineer to take tenders for steel bridge of the bascule type on Pretoria Avenue. The estimated cost of the work is $120,000

Saanich ratepayers have approved by-laws authorizing the expenditure of $450,000 on road improvements—paving and concrete. Mr. Hector S. Cowper is Secretary for the municipality.

The Road Department of the city of Ottawa has prepared plans and details for street grading involving an outlay of nearly $150,000. The work is under the supervision of Mr. F. C. Askwith.

Edmonton has received the assurance that Tramways, Limited, is prepared to proceed with the construction of the Interurban line as oson as arrangements are finally completed by the City Council.

S. Pearson, Son. and Partners, Canada, Limited, a branch of the great English contracting firm, of which Lord Cowdry is the head, have opened an office at 705 Guarantee Building, Montreal. Mr. H. Japp is the manager.

The Midland Railway Company of Manitoba are completing a two-storey warehouse of pressed brick construction at Winnipeg at a cost of $125,000. The Sutherland Construction Company, Winnipeg, are the general contractors.

Excavating is about to be commenced on the new public library which is to be erected at Sherbrooke and Montcalm Streets, at a cost of $200,000. The architect is Mr. E. Payette, Montreal. The work will be carried out by day labor.

A contract for rebuilding the factory of the Bedford (P.Q.) Manufacturing Company has been let to Messrs. Gray and Smith, Montreal. The same firm will also build a dam on the Pike River for the purpose of generating power for the Bedford Manufacturing Company.

Excavations have been made for the new Commercial High School which is to be erected at Toronto for the Board of Education. The building is to be three storeys high, of reinforced concrete, steel and stone construction, containing 24 rooms. The cost is estimated at $260,000.

The new St. Dunstan's R. C. Cathedral at Charlottetown, P. E. I., the erection of which has entailed the expenditure of some $200,000, is nearing completion. The building is roofed and the interior work well advanced. The general contractors are John S. Metcalf Company, Montreal.

At Rosemount, a suburb of Montreal, a new school, estimated to cost $120,000, is being completed for the Protestant Board of School Commissioners. The architects are Messrs. Nobbs & Hyde, of Montreal, and the general contractors are Messrs. A. F. Byers & Company, Montreal.

Building operations are advancing rapidly on the new building which is being erected at St. Boniface by the Hospital Board. The architect is Mr. J. A. Senical, of St. Boniface, and the general contractors are Messrs. J. H. Tremblay & Company, Winnipeg. The cost is estimated at $300,000.

The new Central School at North Vancouver, erected at a cost of $120,000, is now nearing completion. The architect is Mr. W. C. F. Gillam and the general contractors W. J. Smith, Limited. both Vancouver firms. The building is of reinforced concrete and brick construction, fireproof throughout.

Contracts have been awarded for a new school building to be erected on Givens Street, Toronto, at a cost of $160,000. The largest contract, that for the masonry, was awarded last week to Albert Webb at $95,900. The building will be of steel and brick construction and will contain thirty-one rooms.

The rebuilding of the Bank of Toronto, Montreal, has been resumed. The work was interrupted owing to trouble with the foundations, but a contract for this portion is now being carried out by the Simplex Construction Company, Limited. The general contractors are the Atlas Construction Company.

At Toronto, operations have been resumed on the erection of the office building at the corner of Yonge and Albert Streets for Messrs. John Stark & Company. The work had been suspended temporarily. The building, which is to be six storeys high, of steel, terra cotta and brick construction, is to cost $100,000.

Foundation work has been commenced in connection with the new soap factory which Messrs. Proctor & Gamble are to erect at Burlington Street, Hamilton, at a cost of $1,000,000. Building No. 1, which will consist of three storeys and basement and which will cost $200,000, has now been started and plans will shortly be completed for building No. 2. In all there will be six buildings. The construction is steel, reinforced concrete and brick.

The Montreal Council are proceeding with the work of constructing the underground conduits, which it was previously decided to suspend owing to financial conditions. Arrangements have, however, now been made by which the Council are able to go on with the work. Invitations have been issued calling for tenders for constructing a further conduit, from the end of St. Lawrence Boulevard to the harbour front.

At Moose Jaw, Sask., it is not known definitely at this date what expenditures will be made on public works during the coming winter, but recently the city negotiated a loan of $500,000, and it is proposed to use a considerable portion of this sum in the construction of sewer and water mains during the fall and winter. Paving work will represent an outlay of $10,000 and extensions to the city power house $30,000. The City Engineer is Mr. Geo. D. Mackie.

Sir Lomer Gouin, Premier of Quebec, and Mr. J. A. Tessier, Minister of Roads. on October 12 formally opened a new concrete road seven miles long leading from Pont Viau through Cap St. Martin to St. Ross. The celebration took the form of an automobile tour of inspection by a large party of motorists on the invitation of the Provincial Department of Roads, by which the work has been carried out. Forty miles of good roads have now been constructed in

Ile Jesu. This represents an expenditure of $100,000 in Ile Jesu, exclusive of $40,000 expended in St. Rose itself, while in that portion of Laval County situated in the Island of Montreal, $200,000 is being expended on roads.

A still further extension of time has been granted to Mr. Norman C. McLeod, contractor for the Montreal filtration plant. the foundations of which were the subject of a very keen dispute between local engineers of repute. The city have agreed to a year's extension and to advance $50,000, also accepting the responsibility of $27,000 for wages. Mr. C. E. Deakin will be a sub-contractor under the new arrangement. The contract price is $1,158,000.

In a communication to the Montreal Builders' Exchange, the secretary of the Vancouver Exchange refers to the question of tenders for public works, more especially relating to those tenders for Dominion Government works. He states that it is the opinion of the Vancouver Exchange that these tenders should be opened in public at a time specified in the advertisement, and suggests that concerted action be taken with a view to the National Association of Builders Exchanges acting in the matter.

For the month of September the ordinary building permits of Montreal totalled $501,514, as compared with $1,999,524 in the corresponding period last year. By including the work of the current year of the Montreal Harbour Commissioners. such as docks, elevators and sidings—valued at $3,550,000—the total for last month is brought up to $4,051,514. The Commissioners are not bound to obtain a permit, but Mr. A. Chausse, the civic building superintendent, has always contended that the work should properly be included in Montreal's total, and he has done so in his return for September. For the nine months to date the total is $16,209,691, as against $15,816,146, but here again the harbour work is included. Without taking the latter into account the permits would show a decrease of $3,156,455. Last year the harbour work did not figure in the returns until November, when the amount was $3,000,000. The average value of the ordinary permits is lower this year than in 1913.

Personal Mention

Messrs. G. B. Reynolds, of the Trussed Concrete Steel Company; J. A. Stuart, of the A. B. See Electric Elevator Company; and G. M. Gest, have been admitted to the membership of the Montreal Board of Trade.

Mr. R. O. Wynne-Roberts, Consulting Engineer, has returned to Regina after a visit to Montreal, Toronto, New York, and other Eastern points. He was a recent visitor at the office of the Contract Record and Engineering Review.

At the meeting of the Canadian Society of Civil Engineers to be held on October 22, Mr. C. A. P. Turner will read a paper on "The Mechanical Action of Reinforced Concrete Floor Slabs and Columns as interpreted by the character of the deformations under load and the theory of work."

Over one hundred members of the Canadian Society of Civil Engineers volunteered for the front. These include past-presidents and ten past members of the council, together with many active and student members. Lieut.-Col. Ruttan, Lieut.-Col. Greenwood, and Major C. H. Mitchell are among those who offered their services.

Mr. H. A. Drury, principal of the firm of H. A. Drury, Limited, iron and steel merchants, Montreal, died in Atlanta, Ga., while on a business visit to the United States. Mr. Drury, who was a native of St. John, N.B., was 53 years of age. For a long period he was connected with the Imperial Oil Company and resigned about ten years ago to go into business on his own account. His firm represent important British and American companies, being general agents for Canada of the Lackawanna Steel Company, and also representing Sanderson Bros. and Newbold, of Sheffield, Eng. Mr. Drury was a member of the Canadian Mining Institute, and had sat on the council. He is survived by one son, Mr. A. K. Drury.

STANDARD TYPES

By Charles R. Barrett

The Man Who Quits

The man who quits has a brain and hand
As good as the next! but he lacks the sand
That would make him stick, with a courage stout,
To whatever he tackles, and fight it out.

He starts with a rush, and a solemn vow
That he'll soon be showing the others how;
Then something new strikes his roving eye
And his task is left for the bye and bye.

It's up to each man what becomes of him;
He must find in himself the grit and vim
That bring success; he can get the skill,
If he brings to the task a steadfast will.

No man is beaten till he gives in;
Hard luck can't stand for a cheerful grin;
The man who fails needs a better excuse
Than the quitter's whining "What's the use?"

For the man who quits lets his chances slip,
Just because he's too lazy to keep his grip;
The man who sticks goes ahead with a shout,
While the man who quits joins the "down and out."

The Man Who Sticks

The man who sticks has this lesson learned
Success doesn't come by chance—it's earned
By pounding away; for good hard knocks
Will make stepping stones of the stumbling blocks

He knows in his heart that he cannot fail;
That no ill fortune can make him quail
While his will is strong and his courage high,
For he's always good for another try.

He doesn't expect by a single stroke
To jump to the front; he is satisfied
To do ev'ry day his level best,
And let the future take care of the rest.

He doesn't believe he's held down by the "boss"—
It's work, and not favor, that "gets across."
So his motto is this: "What another man
Has been able to handle, I surely can."

For the man who sticks has the sense to see
He can make himself what he wants to be,
If he'll off with his coat and pitch right in—
Why, the man who sticks can't help but win!

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Barton Twp., Ont.

A conference re proposed water and sewer system for Barton Twp., has taken place between City Engineer Macallum, Hamilton, and Barton Twp. Engineer Nicholson. The scheme, as proposed, provides for $50,000 water system, sewer system that will empty into certain city sewers, and a sewer system to cost $10,000 for district east of James Street.

Bosanquet Twp., Ont.

The Township Council has in contemplation the construction of a number of drains. G. Sutherland, Thetford, Ont., is the clerk.

Brantford, Ont.

Surveys have been made for grading, estimated cost $7,000. The work will be done by City Construction Department. Mr. T. Harry Jones is City Engineer.

Canora, Sask.

Work is under way on a waterworks installation, estimated to cost $60,000 The engineers are Messrs. Chipman & Power, Winnipeg and Toronto, and the general contractors are Messrs. W. Newman & Company, Winnipeg. The work comprises pump house, water tower and laying of mains.

Cobalt, Ont.

Surveys have been made by Town Council's Engineers, Code & Code, preparatory to the construction of one mile of 15-in. sewers.

Cranbrook, B.C.

Waterworks system for this city will be completed some time next spring. Leader & Goode are the contractors.

Galt, Ont.

Ratepayers vote October 23 on by-law to raise $55,000 for extension of waterworks system.

Kingston, Ont.

Board of Works has recommended (a) grading of Patrick Street; (b) construction of sewer in College Street; (c) remacadamizing Union Street from Alfred Street to city limits, and (d) construction of a break water in King Street west at an estimated cost of $30,000.

Manitou, Man.

Tenders are to be called for construction of bridge across Pembina River between sections 4 and 5, township 2, range 7, as soon as plans have been prepared by Town Council.

Orillia, Ont.

The Town Council and Water, Light & Power Commission have succeeded in placing practically the whole issue of $85,000 waterworks debentures. The waterworks scheme will be proceeded with.

Ottawa, Ont.

The City Council has taken legal steps to test the validity of an order of Ontario Board of Health which directs that the city spend more than $8,000,000 on a water supply from Thirty-One Mile Lake, more than 50 miles from the capital.

The paving of Lisgar Street, between Elgin and Bank Streets, also Bronson Street, and with Rocmac between Laurier and Slater Streets, is contemplated by City Council. Mr. F. C. Askwith is Acting City Engineer.

Tile pipe sewers are to be laid from Lees Avenue to the Ottawa River. Mr. R. L. Haycock is Sewerage Engineer.

Regina, Sask.

City is proceeding with construction of a 5,000,000-gal. reservoir, provision for which was made in the Capital Estimates of city early this year. The excavation was carried out by day labor, and the work is under supervision of Superintendent of Waterworks.

Extensions to sewage disposal works are being made at a cost of $25,000. Plans and specifications are being prepared for supply of 9,000 sq. ft. of galvanized, corrugated iron for roofing and siding, also for steel work for roof construction of additional filter beds at sewage disposal works.

Richmond, B.C.

Announcement has been made that work will be completed this year on construction of 8 ft. dyke and 20 ft. ditch at an estimated cost of $26,000. Cleveland & Cameron, 470 Granville St., Vancouver, are consulting engineers. J. W. Pike, Vancouver, is general contractor.

St. John, N.B.

City Council will lay 7,000 ft. of watermains on fifteen streets by day labor, at an estimated cost of $18,000. The Water and Sewerage Commissioner is Mr. R. W. Wigmore.

Toronto, Ont.

The Board of Control has decided that the funds required for North Toronto waterworks should be taken from the $6,670,000 voted in 1913 for waterworks extensions. By this means the work will be carried out without submitting by-law.

By-laws to raise $1,340,000 for extension of watermains (including North Toronto supply mains, $525,000, and extensions to high-level pressure fire system, $500,000) are to be submitted to ratepayers. Mr. R. C. Harris is Works Commissioner.

Board of Control has received tenders for Don section, Bloor Street Viaduct, which have been referred to Commissioners for report. The amounts for reinforced concrete and steel respectively are as follows:—$1,125,000, reinforced concrete; $1,136,954.12, steel; $533,445, steel only; $1,109,760.75, steel; $1,353,074.91, steel; $996,564.81, steel; $1,098,781.82, reinforced concrete; $1,249,701, reinforced concrete; $849,005.35, reinforced concrete; $875,000, reinforced concrete.

The extension of Wilton Avenue from Bolton to Logan Avenues is recommended by Board of Control. Estimated cost $622,000.

West Vancouver, B.C.

This city is planning to install a new water system. A concrete dam 100 feet long and 26 feet high, capable of holding 1,100,000 gallons of water, will be constructed at a cost of $15,800. The system will include 18 miles of lap-weld steel pipe, 2,000 of which will be of 4 and 6 inch steel, and provision has been made for the erection of 65 hydrants for fire-protection purposes. The estimated cost of the system is $120,000.

The West Vancouver District is reported to have completed negotiations with the Cotton Company, Limited, Vancouver, for taking bonds in payment of work to be done in opening and improving Marine Drive from North Vancouver to Horseshoe Bay, a distance of about 8 or 10 miles.

CONTRACTS AWARDED

Hamilton, Ont.

McAllister & Company, Toronto, have been awarded the contract for the supply of cement sewer pipe at $16,000.

Niagara Falls, Ont.

Ferris & Manley of this city have the contract for sewer work estimated to cost $2,500. The engineer-in-charge is Mr. F. J. Anderson.

Richmond, B.C.

The contract for paving work between Lule Island bridge and Sea Island bridge has been awarded by Town Council to N. P. Cotton & Company, at $2.30 per yard.

Toronto, Ont.

The Gawne Contracting Company of this city have obtained the contract for sewer construction on Argyle Street, estimated to cost $36,800. Smaller contracts have been awarded to Routly & Summers, J. McGuire, W. E. Taylor, Grant Contracting Company, and the National Contracting Company, all Toronto firms.

Contracts for sidewalk construction in various sections of the city have been awarded to the following firms:—International Contractors, Limited, Britnell Contracting Company, Ramsay Contracting Company, W. E. Ransom, Grant Contracting Company, H. Mitchell, Routly & Summers and R. J. Moyes & Company, all Toronto firms.

The Constructing & Paving Company and the Godson Contracting Company have been awarded contracts for asphalt paving on Paton Road, Boon Avenue, and Withrow Avenue.

Transcona, Man.
G. H. Archibald, Winnipeg, Man., has the contract for building a reservoir (capacity 300,000 gallons) at a cost of $9,000. The engineer is H. N. Ruttan, Winnipeg.

Railroads, Bridges and Wharves

Bruce Mines, Ont.
Ontario Northern Construction Company has been awarded contract for extension of Lake Huron & Northern Ontario R. R. (formerly Bruce Mines & Algoma R. R.), from Bruce mines northerly. Ultimate plans provide for line 325 miles in length. H. Appleton, Bruce Mines, is General Manager of railway.

Brantford, Ont.
The Brantford Street Railway Company has applied to the City Council for a franchise to extend its lines and construct a loop in Brantford. E. B. Stockdale, Toronto, is general manager.

Chatham, Ont.
Plans are being prepared by the City Council for 16 reinforced concrete bridges and dredging works, estimated to cost $84,000. George A. McCubbin, 135 King Street, is the Engineer.

Edmonton, Alta.
The Edmonton Tramways Company, Limited, has completed preliminary arrangements and plans to start work soon on the construction of its proposed line through Edmonton. This is part of a line which will eventually connect Edmonton and Fort Saskatchewan.

Halifax, N.S.
Commissioner E. H. Armstrong, Provincial Government Department Public Works, Halifax, will receive tenders until October 28, for construction of 113 culverts on road from Guysboro to Salmon River bridge, approximately 14.3 miles; also 101 culverts on road from Salmon River Lakes bridge to South River Lake, approximately 11.7 miles. Plans and specifications can be seen at offices of D. P. Floyd, Guysboro, Chas. J. Atwater, Boylston, Alex. Sinclair, Goshen, and at the Department, Halifax.

Kingston, Ont.
Board of Works has recommended a conference with the Government with a view to procuring their co-operation in construction of Public Wharf on water lots [illegible] has been estimated by city engineer at $150,000.

City Council has decided to submit to ratepayers shortly by-law for construction of [illegible] Street W. [illegible]

Longue Pointe, Que.
It is reported that the Canadian Vickers Company will construct a new dry dock here at a cost of [illegible]. Sir Wm. Arrol is designer of the dock which will be [illegible] feet long and [illegible] wide. The permit for building is stated to have been issued.

McNab Township, Ont.
Township Council is considering the construction of new bridge over Waba Creek. Ontario Government, through Colonization road grants, is expecting to bear a portion of the cost.

New Westminster, B.C.
Great Northern Railway Company's architect has received instructions to prepare plans for railway station at this city. Work in connection therewith will be started as soon as possible.

Prince Rupert, B.C.
Grand Trunk Pacific Railway will start construction about January 1 on its dry dock at Prince Rupert.

Paris, Ont.
Grand Valley Railway Company have been authorized to erect station. Work on the proposed building will start immediately.

Province of Manitoba
The C. P. R. will construct a spur line for the Northern Sand & Gravel Company, at Milner, and also for the Winnipeg Supply & Fuel Company, Winnipeg, from a point on existing spur, Section 31. A spur at mileage 1.93, Bird's Hill Branch, will be constructed by the C. N. R. for the Cusson Lumber Company, Transcona, St. Boniface.

Province of Saskatchewan
The C. P. R. is to construct a spur line for Richardson Builders, Limited, Saskatoon, from end of existing spur in southeast quarter section, main line, Saskatchewan division. The same company will build a spur for Campbell, Wilson & Strathdee, Limited, and alter trackage for Regina Cartage Company.

Sudbury, Ont.
The Town Council is constructing four bridges at an estimated cost of $25,000. One has been started, one is nearly completed and work on two is not yet commenced. Mr. D. L. Brown, Cedar Avenue, is the general contractor, and Messrs. Clarke & Monds are engineers.

Uxbridge, Ont.
The Provincial Hydro-Electric Commission, in conjunction with the various municipalities, will probably start the lonstruction of the following lines this fall: Toronto to Unionville, approximately 14 miles; Unionville to Uxbridge, via Vandorf, approximately 25 miles; Unionville to Brooklyn through Markham; Unionville to Stouffville and Port Perry; also spur line from Vandorf to Newmarket. The cost per mile of the line from Unionville to Uxbridge is estimated at [illegible] including road, rails, buildings, bridges, roadways, etc. Electric equipment, including car barns, terminals, etc., will cost about $12,500 per mile.

CONTRACTS AWARDED

London, Ont.
The contract for construction of single-span steel and concrete bridge [illegible] long, [illegible] wide, across [illegible] Street at an estimated cost of $14,300, has been let by City Council and County of Middlesex to Messrs. [illegible], Toronto. Mr. Wm. N. Ashplant, City Hall, is Engineer in charge.

Winnipeg, Man.
Final estimates have been approved as follows in connection with Greater Winnipeg Water District: [illegible] supply of [illegible] Lumber Company [illegible] and rails, Algoma Steel Corporation, Limited, $8,869; splice bars, Steel Company of Canada, Limited, $4,[illegible]; [illegible] & Fleming, $14,829; buildings at Deacon, C. J. E. Maxwell, $3,899; railway ties, O'Brien & McDougall Bros., $27,010; railway construction, Northern Construction Company, $97,565.

Public Buildings, Churches, and Schools

Buctouche, N.B.
Buildings comprising Victoria Hotel, sample rooms and barn owned by John H. McCleave, also station and freight sheds, property of Moncton & Buctouche Railway, residence and barn (W. H. Irving) and warehouse (A. & R. Loggie), have been destroyed by fire. Extent of loss is not reported.

Fairbank, Ont. (Toronto)
Proposal to erect new school buildings is receiving consideration by School Section No. 15, Township of York, the secretary of which is Mr. Wm. Deacoff, Fairbank.

Fort Frances, Ont.
The Town Council contemplate the erection of a public hall on Trunk Road in Crozier Township, for Municipality of Alberton. Mr. F. H. Warner, Fort Frances, is the Town Clerk.

Hamilton, Ont.
The contract for roofing Wentworth Street School and supplying blackboards, which was awarded to Mr. V. Drew, has been cancelled and new tenders will be called at once. Mr. P. H. Foster is Secretary, Board of Education.

Board of Education has decided to call new tenders on carpentry work in respect of school on Dundurn Street, Mr. Calvert, who had been given the contract, having asked to be released. R. H. Foster is Secretary.

Lower Squamish, B.C.
Tenders will be received by J. E. Griffith, Deputy Minister of Public Works, Vancouver, until noon, October 31, for erection of four-room school at Lower Squamish, Richmond Electoral District. Plans and specification are at office of Mr. J. Mahoney, Government Agent, Court House, Vancouver; Mr. J. D. Fraser, Sec. of School Board, Cleveland Avenue, Squamish, and at Department, Vancouver.

Montreal, Que.
Detailed plans are not yet completed for $200,000 public library to be erected on Sherbrooke and Montcalm for Board of Commissioners. As soon as contract for foundation work has been approved by City Council work will be started by Foundation Company, Limited, Montreal. E. Payette, 103 St. Francois Xavier Street, is the architect

North Bay, Ont.
The [illegible] building in connection with [illegible] church for French R. C. Community may be started next spring. Foundation work will be completed this year.

New Hamburg, Ont.
The Town Council has awarded the general contract for construction of $8,000 public library to Geo. Clair, New Hamburg. Building will be one storey, 36 and 53, red pressed brick construc-

tion. J. S. Russell, 21 Downie Street, Stratford, is the architect.

Nanaimo, B.C.

City Council has decided not to present by-law providing $5,000 for upkeep of proposed Carnegie Library for construction of which $50,000 has been appropriated by Carnegie Corporation of New York.

Niagara Falls, Ont.

The Public School Board have in contemplation erection of an addition to school at an estimated cost of $18,000. Geo. Mortimer is the Secretary.

Norwood, Ont.

The Village Council has decided to build a brick and concrete library for which tenders will be called next year. E. J. Larry is the Clerk.

Sunkist, Sask.

The construction of two-storey, 50 x 75 frame school building, is contemplated by New Hazelton school district, No. 3382, the Secretary-Treasurer of which is Mr. Geo. W. Ames, Sunkist P.O.

Summerside, P.E.I.

Tenders for interior fittings for post office will be received by R. C. Desrochers, Secretary, Dominion Government Department Public Works, Ottawa, until November 2. Plans and specification are at office of Mr. Wm. N. Heustis, Clerk of Works, Summerside; Mr. W. J. McDux, Supt. Charlottetown, and at Department, Ottawa.

Toronto, Ont.

The Board of Control has resolved to erect a new Zoological house at Riverdale Park, estimated to cost $8,000. Building will be concrete and brick construction. Mr. C. E. Chambers is Parks Commissioner.

The Board of Education (W. C. Wilkinson, Sec.-Treas.), has awarded contracts as follows for school telephones: Hester Hows School, Lintz Porter Company, $202; Earlscourt School, Dufferin School and Clinton School, G. J. Beattie, $267, $312 and $263 respectively.

The contract for masonry work in connection with Givens Street School, which was awarded to Albert Webb, 13 Shirley Street, was let at $85,900 and not $95,900 as previously reported.

Toronto, Ont.

Tenders close with architects S. B. Coon & Son, 409 Ryrie Building, on November 5, for construction of $60,000 school at East Toronto, for School Section No. 26, York Township. The building will be two storeys and basement, 133 x 80 ft., 10, rooms, stone, terra cotta, steel and brick construction.

Property Committee has approved of plans for new addition to North Toronto high school, and tenders will be called shortly.

Vancouver, B.C.

Department of Public Works has completed plans for the proposed Government elevator, capacity 1,500,000, to be erected on Government dock site, and equipped with the latest machinery. As soon as specifications have been completed tenders will be invited.

Winnipeg, Man.

The Board of Control will receive tenders until October 23rd for construction of asphalt pavement on lane east of Main Street, for Market Avenue South to Confederation Life Building. Plans and specification can be seen at office of W. P. Brereton, 223 James Avenue.

Windsor, Ont.

Some trades will be let in connection with $5,000 garage being erected on Chatham Street, for Fitz Bridges.

CONTRACTS AWARDED

Hamilton, Ont.

The Board of Education has awarded the following contracts for construction of public school, two storeys, 12 rooms, steel and brick construction, on Wentworth Street North, at an estimated cost cost of $60,000: masonry—T. Jones, $29,980; carpentry—Stuart Bros., $10,497; plastering — Hannaford Bros., $2,740; painting—W. Dodson, $1,900; roofing—V. Drew, $1,140; sewers—J. J. Armstrong, $178; heating and plumbing—A. Clark, $13,975; electrical work—Electrical Supply Company, $979; steel—Hamilton Bridge Works Company, $1,779; iron work—Canada Wire Goods Company, $2,550.

Regina, Sask.

Wesley Methodist Church trustees have let the general contract for construction of $12,000 church on 15th Avenue and St. John, to Constructors, Limited, Regina. Building will be 100 x 125 ft., concrete foundation, brick and frame construction.

Nelson & Squetch, Regina, has been awarded the contract for painting work in connection with re-decoration of City Hall.

Business Buildings and Industrial Plants

Deloraine, Man.

The erection of a skating rink, 160 x 60, for this town is in contemplation at an estimated cost of $4,000. Shillinglaw and Marshall, 829 Rosser Street, Brandon, are the probable architects.

Essex, Ont.

Johnson & Rogers have in contemplation construction of $8,000 white brick store.

Fort William, Ont.

Ogilvie Flour Mills, who are erecting a $2,000 garage on River Front by day labor, will require gasoline tank and pumps.

Grosse Isle, Que.

The Dominion Government Department of Public Works are undecided whether to construct Detention Building this year or not. A report issued July 17th that general contract had been let is inaccurate as contract has not yet been awarded. Proposed building is estimated to cost $45,848, and will be two-storey and basement.

Hamilton, Ont.

Plans will be ready shortly for four-storey 200 x 60 factory, steel, hollow tile reinforced concrete and brick construction, for Proctor & Gamble, Ivorydale, Ohio and Burlington Street, Hamilton. Group of six buildings, estimated to cost $1,000,000, will be erected, No. 1 factory, involving an outlay of $200,000, 3-storey and basement, 100 x 50, being at present under construction.

Listowel, Ont.

The cooperage owned by Pfreffer Milling Company has been destroyed by fire. The loss, estimated at $2,000, is covered by insurance.

London, Ont.

The contract is to be let shortly for construction of store fronts, barber shop and apartments, for Mr. Harry Ryan, 340 Richmond, at an estimated outlay of $3,000. Watt & Blackwell, Bank of Toronto Chambers, are the architects.

London Township, Ont.

The construction of farm buildings estimated to cost $3,500, concrete and stone foundation, fireproof construction, is contemplated by W. E. Talbot, Ballymote P. O.

Montreal, Que.

Tenders will be invited soon by Turner & Carless, 49 Beaver Hall Hill, Montreal, architect, for electrical and interior fittings in connection with five-storey bank and office building, in course of construction on St. Lawrence and Ontario Streets, for Molsons Bank.

Niagara Falls, Ont.

Dovesmith Invention Development Company contemplate construction of factory in which to manufacture speed gears for automobiles. F. McIntyre, Empire Building, is the Secretary.

North Bay, Ont.

Tenders are in but contract has not been awarded in connection with $16,000 stores and apartments to be constructed on Main Street for T. N. Colgan, Ferguson Street. Owner intends building by day labor next spring.

Ottawa, Ont.

Plans are in progress for erection of roller sheds for City Council.

Preston, Ont.

Plans have been drawn for alterations to picture theatre owned by Doherty & Kennedy. Building will be remodelled as regards interior decorations, electrical and motion picture equipment, seating, etc.

Town Council has decided to have plans prepared at once for 40 x 60 ft. additions to market building.

Quebec, Que.

The plant of the Modern Joint Foundry Company in Three Rivers annex has been destroyed by fire. The damage, which is heavy, is said to be covered by insurance.

Regina, Sask.

Regina Labor Temple Company, Limited, who have had plans prepared for construction of labor temple, 50 x 75, at an estimated cost of $30,000, have decided to postpone project for the present.

South Vancouver, B.C.

Building Inspector Hubbard, architect, is receiving tenders for construction of fire hall, estimated cost of which is $10,000.

Sherbrooke, Que.

Geo. Delorne, Brooks Street, is contemplating the building of a stable and P. Desrochers, Windsor Street, a garage.

St. Catharines, Ont.

Barns, etc., the property of Wm.

Bowman, 123 Queenstone Street, have been destroyed by fire. Loss $6,000;

St. Gabriel de Brandon, Que.
Tenders will be received by R. C. Desrochers, Secretary, Dominion Government Department Public Works, Ottawa, until 4 p.m., October 28th, for interior fittings for post office. Plans and specification are at office of Mr. A. Michand, Clerk of Works, St. Gabriel de Brandon; Mr. R. L. Deschamps, Overseer, Montreal Central Post Office, and at Department, Ottawa.

St. Jerome, Que.
By-law to authorize erection of two factories, 1-storey each, 100 x 50, brick construction, for Metal Products, Limited, 341 DeGaspe Avenue, Montreal, has been defeated at St. Jerome. It is announced the company will build elsewhere, but location has not yet been decided. Benoit & Girard, Southam Building, are the architects.

Three Rivers, Que.
Foundry plant, owned by Modern Joint & Foundry Company, 290 Nicolet Street, Montreal, has been burned down, all buildings being destroyed.

Toronto, Ont.
Tenders addressed to Sir Adam Beck will be received until October 24th, time having been extended, for construction of $300,000 office building on University Avenue for Provincial Hydro-Electric Commission. Building will be six-storey and basement, 80 x 70, steel and brick construction.

A permit has been issued to C. Legg, 1683 Danforth Avenue, to erect $3,000 brick and stone garage.

Works Commissioner Harris has written the Works Committee urging the necessity of providing funds for the erection of building for Waterworks Department on site of St. Andrew's Market. Estimated cost $100,000.

Norcross Bros. Company, 98 Bay Street, Sherwood & Sherwood, Mail Bldg., and Chalkley & Son, 34 Victoria Street, will receive estimates for all trades in connection with $300,000 office building to be constructed on University Avenue for Provincial Hydro-Electric Commission.

Wallaceburg, Ont.
Canadian Canning Company will install modern equipment in canning factory which they contemplate erecting in Wallaceburg, at an estimated cost of $20,000. Architect has not yet been appointed

Welland, Ont.
Loss estimated at [illegible] has been caused through destruction by fire of barn, owned by Geo. Burnison, Elizabeth Street. Property was partially insured.

Winnipeg, Man.
Furniture warehouse of J. A. Banfield, [illegible] Main Street, has been burned down involving a loss of about $40,000.

Wynyard, Sask.
The erection of [illegible] flour mill is contemplated by H. C. Miller, Mannell Street

CONTRACTS AWARDED

Wallaceburg, Ont.
Contract for addition to [illegible] general store has been awarded [illegible] Crothers, James Street, owner, to Chas. Wolliver.

Residences

Ailsa Craig, Ont.
Wm. Hay, Main Street, will build $65,000 residence of red pressed brick construction.

Dundas, Ont.
J. E. Walker, architect, Toronto, has prepared plans for a two-storey brick residence, estimated cost $6,000, for Dr. C. E. Nicholson, Dundas.

Hamilton, Ont.
Date for receiving tenders has been extended until October 24 in connection with $50,000 apartment house to be constructed on East Avenue and King William Street, for T. H. Pratt, 20 James Street North. Building will be three storeys, 114 x 44, brick construction. Stewart & Witton, 7 Hughson Street S., are the architects.

Excavating has been made for a $5,000 residence, two-storeys high, of brick construction, for Sparks & McKay of this city.

London, Ont.
By-laws have been passed by City Council for concrete walks on seven streets, also gravel roadway on Wharncliffe Road from Ridgeway to Bridge. W. N. Ashplant is City Engineer and Samuel Baker, Clerk.

Ottawa, Ont.
W. Herbert George, architect of this city, has prepared plans for a brick veneer residence, estimated to cost $5,000 for Mr. L. Bangs.

Walter Fryer, Glenn Avenue, will build a 2½-storey brick veneer residence on Roslyn Avenue, at a cost of $3,500.

Port Stanley, Ont.
The Anglican Church Congregation is contemplating the erection of a $4,000 rectory. The architect has not yet been appointed.

Quebec, Que.
G. E. Ward is building a three-storey frame and brick residence on La Canardiere Street at a cost of $4,000.

The three-storey residence which P. Marceau is building on Sixth Street at a cost of $10,000 has reached the roofing stage.

Sherbrooke, Que.
Construction of $6,000 tenement on Portland Avenue, two storey, 38 x 38, frame and brick, is contemplated by Geo. Long.

Toronto, Ont.
Tenders for about ten pairs of residences, estimated cost [illegible], to be constructed on Woodbine Avenue, by Building Corporation of Toronto, Limited, will be received until October [illegible], in bulk or separate trades or day labor only. W. H. Martin, 70 King Street, is the architect and superintendent. Proposed residences will be [illegible]-storey brick construction.

Tenders are required on tinsmithing, heating and electric wiring, in respect to [illegible] residences for J. G. Stanhope, 42 Balliol Avenue.

J. McCracken is building a 2½ storey brick house on East Lynne Avenue, at a cost of $4,000. Exterior work is nearing completion.

Foundations are in for a pair of 2½-storey brick residences on Meagher Avenue, estimated to cost $6,000. The owner is the Rev. R. Hobbs and the general contractor is A. Binns of this city.

Vancouver, B.C.
Tenders will be received by W. H. Baggs, Dawson Building, of this city, until 5 p.m. October 27, for installation of heating system in two glass houses at Stanley Park for City Council. Plans and specification are at office of Parks Commissioner.

Wolfeville, N.S.
C. H. Wright is contemplating the erection of a frame house this fall, at a cost of $3,000.

Wynyard, Sask.
L. P. McNamee has plans prepared for a $5,000 dwelling.

CONTRACTS AWARDED

Ottawa, Ont.
The following contracts have been let by City Council for new intake pipe repairs, estimated to cost $50,000; steel—Campbell Iron & Steel Works, Limited; and gaskets—Castings Limited, both of Ottawa. Work is being done by day labor. R. S. Haycock is Waterworks Engineer.

Regina, Sask.
The contract for supply of sidewalk rails for Broad Street subway has been awarded to Crane & Ordway Company, Winnipeg.

Power Plants, Electricity and Telephones

Chatham, Ont.
The ratepayers have approved by-law to expend $90,000 for the installation of Hydro-Electric system. W. G. Merrit is the city clerk.

Hull, Que.
Plans are being prepared for an extension to Redistribution Station. Estimated cost $100,000

Kincardine, Ont.
Bruce County Telephone Company have decided to make numerous extensions to their system in this district and a quantity of equipment will be purchased. Mr. B. A. Malcolmson, Kincardine, is the manager.

St. Johns, Ont.
It has been decided to equip a substation at St. Johns in connection with new Hydro-Electric line between London and Lucan.

Williamsbury, Ont.
A by-law to raise $2,750 for the provision of an electric power plant is being submitted to the ratepayers.

Miscellaneous

Belmont, Ont.
Southern Ontario Gas Company intend laying gas line to Belmont connecting with main to Ingersoll. The company will require gas equipment. F. B Tomb, London, is the manager.

Burlington Beach, Ont.

Beach Commissioners (Lt.-Col. J. J. [illegible] [illegible], Chairman) anticipate the laying of gas mains next spring.

Edmonton, Alta.

The Provincial Legislature is reported to be raising a loan of $3,000,000 principally for the carrying on of public works authorized by the Legislature.

Ottawa, Ont.

Separate tenders will be received until October 26 by John Henderson, Clerk of City Council, for lavatories on O'Connor Street, at an estimated outlay of $14,000, to be solid brick construction, concrete foundation.

New Companies

Orford Bay Lumber & Logging Company, Limited, has been incorporated with head office at Vancouver, B.C., and capital of $175,000.

F. St. Vincent Limitee, has been incorporated with a capital stock of $20,000 and headquarters at Montreal, with power to construct and operate hotels, apartment houses, residences, factories, etc.

The Upper Wahnapitae Improvement Company, Limited, is a new incorporation with a capital of $40,000, with power to construct drains, piers, etc., and to facilitate transmission of lumber on Upper Wahnapitae River. The headquarters of the company is at Sudbury, Ont.

Western Foundation Company of Canada, Limited, has been incorporated with $200,000 capital, to carry on business as contractors for construction of railways, canals, harbor works, etc. Mr. G. S. Deeks, 14 Wellington Street E., Toronto, where the head office is situated, is interested.

Foley Brothers, a U. S. A. Corporation, have been licensed in Ontario as railway, bridge, sewer and general contractors.

Western Foundation Company of Canada, Limited, have been incorporated as contractors for deep foundations, harbor works, cement works, etc., also as building contractors. The company has a capital of $200,000, and the provisional directors are Geo. S. Deake, Thos. R. Hinds, and Thos. F. Hinds. The head office will be at Toronto.

Penberthy Construction Company, Limited, was incorporated recently with a capital of $60,000. The head office is situated at Toronto and the provisional directors are Wm. R. Mather, A. J. Penberthy, Jas. Parker and Chas. W. Kerr.

Montreal and Lake Shore Land Company, Limited, is a new incorporation with a capital stock of $50,000, and head office at Montreal. The new company will undertake all kinds of building and contracting work, also dealers in stone, sand, lime, brick, timber and other building materials.

Canadian Road Contractors Company has been incorporated with a capital stock of $500,000 as a general engineering and construction company. The head office will be at Montreal.

A Manchester, Eng., firm of wholesale hardware and metal merchants wishes to get in touch with exporters of wire nails and bolts and nuts from Canada.

Business Notes

The waterworks at Haileybury, Ont., are being equipped with water level recorders furnished by Messrs. Gent & Company, Limited, Leicester, Eng. The Waterworks Superintendent at Haileybury is Mr. Thos. Lennox.

The Canada Metal Company of Toronto is reported to have obtained a large order from the Dominion Government for the manufacture of bullets for shrapnel.

The Link-Belt Company of Chicago and Philadelphia have received an order from the Navy Department of the United States Government for four steam-operated revolving locomotive cranes. Three of these cranes will be used at the Philadelphia Navy yard and the fourth will be used at Charleston, Md. All the locomotive cranes are of the company's standard 8-wheel type with slight modification to conform with government specifications.

The Canadian Sardine factory at St. Andrews, which cost over a half million dollars to construct, has been sold to the Bank of Nova Scotia. It is expected that the factory, which has not been in operation for some time, will reopen shortly under the new management.

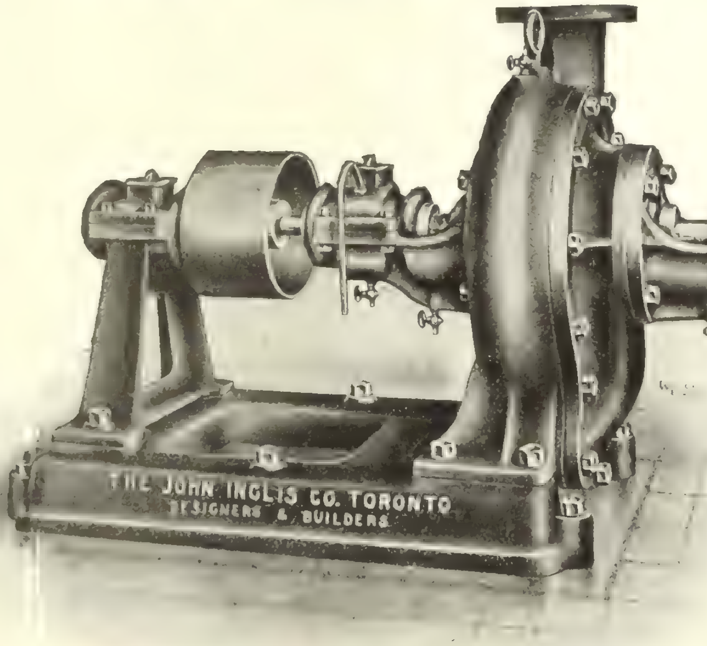
The placing of concrete is one point where the material is abused to the greatest extent, observes a writer in Concrete-Cement Age. We take care of a green brick wall, but do not hesitate to walk over and conduct operations over concrete which has not reached its final set, thereby destroying the surface of the concrete for all time. While this may not be serious in some cases, it is certainly not desirable in thin concrete slabs.

Unit costs of construction of a boiler house at the Lake View Pumping Station, Chicago, are given in the 1913 annual report of John Ericson, city engineer, as follows: Lumber and nails for each section of 26-ft., Wakefield yellow pine sheeting made up of three pieces of 2 x 12-in. planks with 3-in. tongue cost $5.09 and labor cost 81 cents. Excavation of 7,893 cu. yds. of sand and earth by a ½-yd. Hayward clamshell bucket operated by an Orton & Steinbrenner locomotive crane was carried out at a unit cost of $1.02 per cubic yard. Old masonry, 656 cu. yd., was broken up with dynamite loaded into wagons and used for filling in the lake front at $3.35 per cubic yard. From twenty-tight caissons 4½, 5 and 5¼ ft. in diameter, 1,011.5 cu. yds. of excavation were removed at $13.36 per cubic yard, 826.3 cu. yds. of 1:2:4 concrete placed at $5.57; an average cost per caisson, carried to hard pan to depths carrying from—47.2 to—4.13 was $646.83. Exclusive of caissons 234.8 cu. yd. of concrete cost $11.03 per cubic yard. This is high, says the report, because the work consisted of placing concrete in an old suction shaft, drainage sumps and conveyor trench in expensive forms, some of the concrete having to be deposited with buckets.

As foundations for the new building of Reid, Murdock & Company in Chicago were endangered by the existence of the abandoned cross-town water tunnel which passed under the property in a northeasterly direction, the city filled in 227 ft. of the tunnel with concrete to avoid accidents and damage suits. The piles for the new building extend 60 ft. below datam, and there was likelihood of their piercing the tunnel roof. Details are given by John Ericson, city engineer, in the 1913 annual report to the Board of Public Works. To get into the tunnel a shaft was sunk 40 ft. north of the river dock line, but when down to El. —38, water broke into it, rising to El. —33, the elevation of the water in the tunnel. After removing the water with a No. 3 Emerson steam pump the shaft was completed, striking the tunnel a little east of the centre line and 5 ft. north of a bulkhead, cutting off the river section. After pumping all water from the tunnel a timber bulkhead was placed on the west line of north Clark Street. A pneumatic concrete placing machine was rigged to transport concrete above ground through 120 ft. of 8-in. pipe to the 60-ft. shaft, down the shaft and 150 ft. underground. After several trials, states the report, the pipe line was removed and the work of filling the tunnel was done by hand. Once begun, the concrete was continued uninterruptedly for eight days. The 4-ft. shaft was filled with sand. Labor cost $3,976.87; materials and supplies, $1,547.97; engineering and inspection, $359.87, making an average cost of $25.90 per linear foot for a 9-ft. diameter bore.

Danger of winter construction of concrete buildings due to freezing has now been eliminated by modern methods of procedure, as an instance of which we may mention the methods employed in the erection of a concrete factory building for the New York Consolidated Card Company, Long Island City. Excavation for the foundations of the north end of the building was begun October 21, 1913, and the roof placed December 23. Work on the south end began November 26, and the roof was finished January 30, 1914. The temperature during January ranged from 5 to 58 degrees, with a mean temperature of 31.4 degrees. Materials for the south end of the building were shipped in while the north end was under construction, and stored near the mixing plant in the centre of the north part of the building. Some 36,000 bags of cement were thus stored at one time, covered with tarpaulin, ready for use. Arrangements for heating sand and gravel, water farrel and steel reinforcement and forms were made at the same time. Griddles of steam coils were used for heating the sand and gravel, a steam jet was connected with the water barrel, and reinforcing rods were sprayed with steam to remove ice particles just before placing. That part of the factory under construction at one time was then completely covered with tarpaulins, above and on the outside, while salamanders were placed on the floor beneath, holes being left in the floor forms to permit the heat from the burning coke to penetrate up to the floor. A salamander was placed on every 300 sq. ft. of floor area. Over the floor above the tarpaulins were hung on scantlings 12 inches above the floor immediately after placing the concrete. In all, 765,000 lbs. of coke were used, 50,000 sq. ft. of canvas, and 71 salamanders in the construction of the building. While the cost was thus made slightly greater than ordinary summer construction, this was offset by the profit due to early completion.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Tenders and For Sale Department

Tenders Wanted

Separate and Bulk Tenders on the various [illegible] received by the Board of Education of School Section No. 26, Township of York, East Toronto, from Oct. 15th to Nov. 5th, for a [illegible] Public School of fireproof construction, brick, stone and terra cotta with steel sash, terrazo floors, steel stairs, plumbing, steam heating and ventilation, etc. Lowest or any tenders not necessarily accepted.

Plans, specifications and tender forms may be seen at the office of S. B. Coon & Son, Architects, 409 Ryrie Bldg., Toronto. 42

Tenders for Drain

Tenders will be received by the Municipal Council of the Township of Grey, County of Huron, up to **Tuesday, October 27th,** for the construction of the Beauchamp Creek Drain in the Township of Grey. Estimated cost of work $23,000. Plans and specifications at Clerk's Office, Ethel.

A. H. MACDONALD,
Clerk, Twp. of Grey,
Ethel P. O.

42

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, October 30th, 1914

for all trades

Enlargement of Roden School

New Building, Ryerson School Annex

Electrical Work, Harbord Street Collegiate

Cabinet Work, Oakwood and Parkdale Collegiates

and for Sundry Schools

Metal Cupboards

Metal Lockers

Weather Strips

Composition Floors

Steel and Glass Partitions

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer, at his office, in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

J. W. JACKSON,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

42

Sales Agents Wanted

Large firm making electric centrifugal pumps, automatic electric compression water systems, electrically-driven multiple storage turbine pumps, and electrically-driven double acting pumps, wants sales agents in various parts of Canada. Representatives will be backed up with a liberal advertising campaign. Apply Box 86, Contract Record and Engineering Review, Toronto. 42-43

CAPITAL introduced for sound enterprises of all kinds. 5 per cent. commission. Bond and stock issues placed. Underwriting procured. References exchanged. Address Cooke & Byrne, Harcourt Street, Dublin, Ireland. 40-45

Situation Wanted

Draftsman who has had four years' experience with the fan heating and ventilating business desires position where at times he can make use of his experience.

H. M. FORD,
919 New Birks Building,
Montreal, Que.

42

Mechanical Superintendent

desires change. Has filled this position in connection with operations in England, Canada, India, Egypt and China. Capable of taking absolute control of mechanical end of any project. References on request. Box 87, Contract Record, Toronto. 42-44

Late News Items

Brickville, Ont.
The masonry contract in connection with the carrying out of alterations and addition to "Fairknowe" Orphans' Home, King Street, has been awarded to W. Pattison & Company. Mr. B. Dillon, King Street, is the architect.

Crowland Township, Ont.
Methodist Church Congregation have decided that instead of building new church they will purchase church in the vicinity. Arrangements to this end have accordingly been made.

Hamilton, Ont.
Plans have been drawn for $15,000 apartment house to be erected on Herkimer Street, for Mr. Thos. Ramsay, Market Square. Residence will be three-storey, brick construction. Owner is uncertain as to when operations will be started. Mr. E. B. Patterson, 167½ King Street East, is the architect.

The Newaygo Company, Limited, has been incorporated with head office at Port Arthur, Ont., and a capital of $200,000, to carry on general business of lumber merchants and to erect saw mills, etc.

Jas. Horrigan & Company, Limited, has been incorporated with a capital of $100,000 to carry on the sawmills and lumber business. The headquarters of the firm is at Port Arthur, Ont. Mr. Jas. Horrigan, contractor, is interested.

Kingston, Ont.
Mr. C. Schnell, Patterson, N.J., contemplates erecting plant here for reduction of potash from feldspar.

London Township, Ont.
The Township Council has in contemplation the construction of a number of drains. Mr. F. W. Farncomb, Bank of Toronto Chambers, London, is engineer.

Maisonneuve, Que. (Montreal)
Work is to start immediately on construction of public market, estimated to cost $100,000, for Town Council. Building will be 2½-storey, brick, granite and stone construction. M. Dufresne, Ontario Street, is the architect.

Montreal, Que.
The projected erection of apartment buildings on Mount Royal Avenue, by Parent Bros., 56 St. James Street, at an estimated cost of $12,000, has been abandoned.

Board of Control has decided to carry through a number of public works during the winter.

Niagara Falls, Ont.
Tenders are being received for plumbing in connection with $8,000 store on Queen Street, for W. H. Buckley, Erie Avenue. Tenders for glass will be called later.

Newmarket, Ont.
Messrs. Smith & Rutledge are in the market for one portable 25 h.p. engine, one portable 25 h.p. boiler, also one gas generator.

Outremont, Que. (Montreal)
Tenders have been received for construction of $25,000 residence on Ainslie Avenue for H. P. Labeelle, 145 Sherbrooke Street Eeast. The contract has not yet been awarded but it is expected that work will be commenced next spring. The building will be three-storey, 45 x 32, brick and stone construction.

Orillia, Ont.
Town Council has passed by-laws for laying of sewers in several streets.

Regina, Sask.
Sub-contracts in connection with addition to hospital have been let as follows: supply and installation of signalling system, Northwestern Electric Limited, $1,299; installation of power leads, Whiteford Brothers, $292; covered boilers, Canadian Asphalt Company, $340. R. N. Darrach, Western Trust Building, is the architect and R. J. Lecky & Company, Limited, Regina, are the general contractors.

Toronto, Ont.
The municipalities along the route of the proposed Hydro Radial Railway between Toronto and northwestern points voted by by-law on October 19th in favor of the construction of the road. This empowers the respective municipal councils to enter into an agreement with the Provincial Hydro-electric Commission to have the scheme carried through. According to the terms of the by-law each municipality will issue debentures covering the proportion of cost for which it will be responsible. The estimated cost of construction, esuipment and operation is as follows: Newmarket, $266,986; Williamsburg, $2,750; Markham, $48,762; Pickering, $578,115; Twp. of Scarboro, $565,714; Markham, $803,-939.

Air Compressors

of Belliss Make have gained their reputation for

Simplicity of Design
Compact Design
Continuous Operation
Noiseless Running
Low Oil Consumption
Overall Efficiency

Messrs. Belliss & Morcom, Ltd.
BIRMINGHAM, ENGLAND

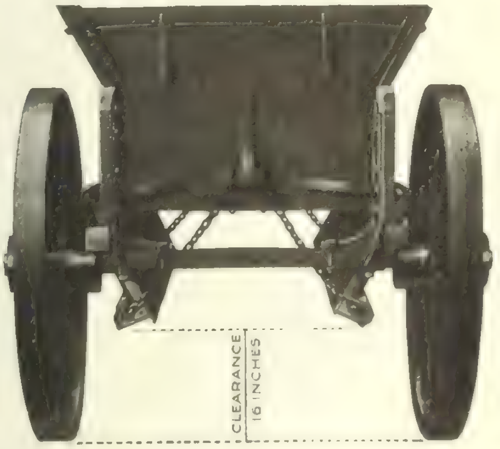
Agents
Laurie & Lamb
Board of Trade Building, MONTREAL

RIVETED TANKS RIVETED PIPES PONTOONS

and other similar works

Manufactured by
Canadian Stewart Co., Limited
TORONTO

The Last Ten Dollars



in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

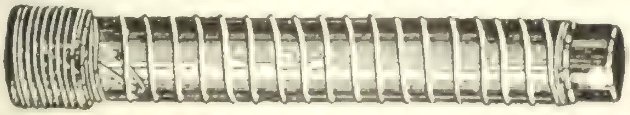
John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario



Continuous and Machine Banded Wood Stave

WATER PIPE

Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
Write for Catalogue
Full Particulars and Estimates Furnished

Vault Doors and Safes

J. & J. Taylor
Toronto Safe Works
Established 1855 TORONTO
Branches: Vancouver and Winnipeg
Montreal

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 70)

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38, 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 85 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

HOISTING ENGINES

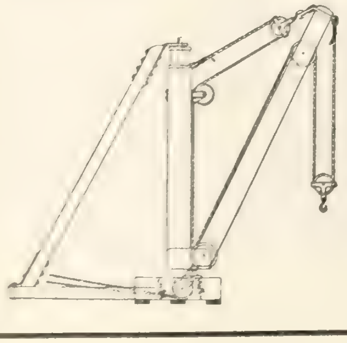
DERRICKS

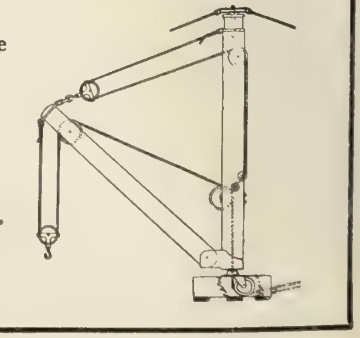
HORSEPOWERS WINCHES OR CRABS

Standard sizes and capacity of derricks in stock for immediate shipment.

Get our prices—they will interest you.
All goods guaranteed.

MARSH and HENTHORN, LIMITED, Belleville, Ont.
Designers and Builders of Hoisting Machinery
Sales Agents: MUSSENS, LIMITED, Montreal, Que.





Canada Wire & Cable Co., Limited

Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes.

Electric Railway Trolley Wire and Feeder Cable.

Sales Offices and Branch Warehouses:

401 Lake of the Woods Building, MONTREAL.
150 Princess Street, WINNIPEG.
Macdonald Marpole Co., Ltd., 427 Seymour St., VANCOUVER.

Prompt shipments from Factory or nearest warehouse.

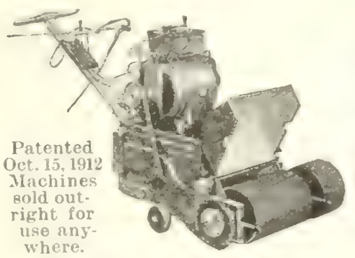
THE AUTOMATIC BALL BEARING ELECTRIC FLOOR SURFACING MACHINE

Contractors and builders find, dresses in paying quantities, quarter-sawed oak, maple, etc., the way they want it or rapidly refinishes old floors. Having ballbearings, roller and dust-suction fans spin true and easy: yielding arms give flexible or rigid roller as needed; self-propelling with automatic control gauges roller cut for even work and brakes forward pull for large capacity—you simply guide. Surfaces to base baseboard with Edge Roller. No hand scraping.

Booklet tells all about it and our

FREE TRIAL OFFER

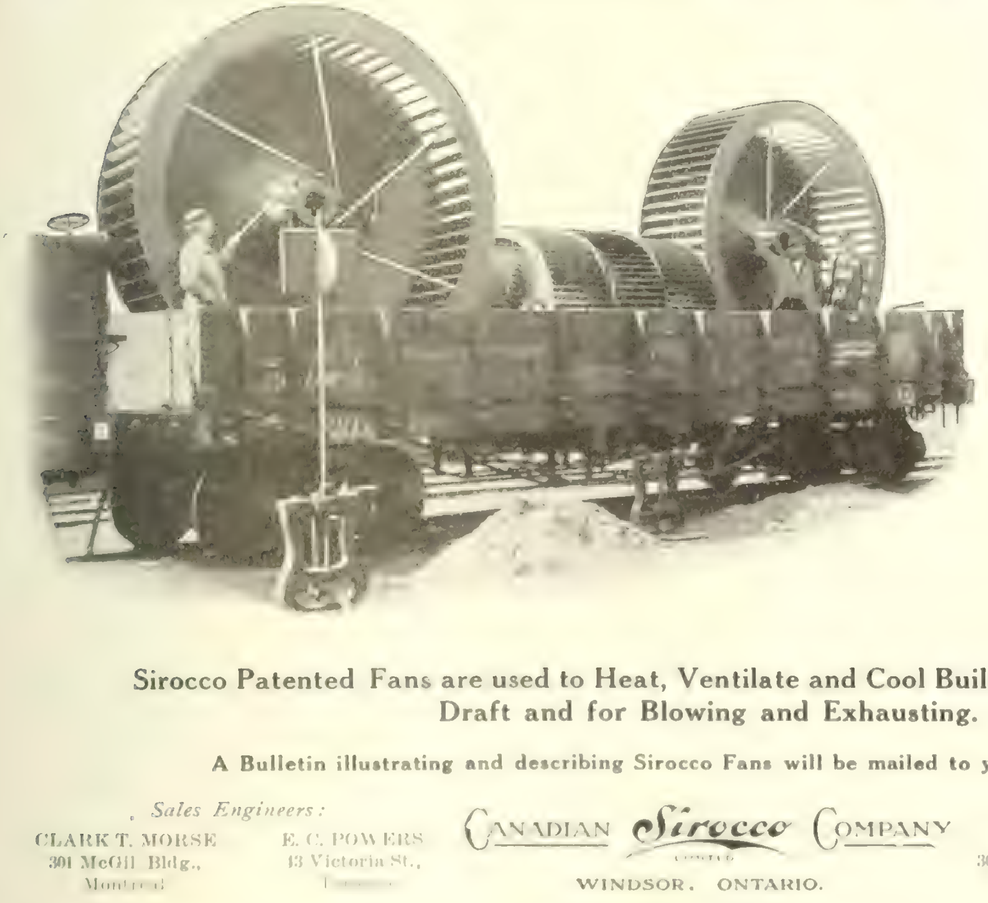
Made in several sizes for small rooms or large areas. Let us send you the names and addresses of Canadian owners near you.



Patented Oct. 15, 1912 Machines sold outright for use anywhere.

Wayvell Chappell & Co.

Dept. F, 4845 Ravenswood Ave. **CHICAGO, ILL.**



The Genuine

"Sirocco"

TRADE MARK.

Patented Multi-Blade Fans and Blowers

The British Navy has indorsed Sirocco Fans to the extent of installing them in their famous fighters to the exclusion of all other types.

Sirocco Patented Fans are used to Heat, Ventilate and Cool Buildings—for Mechanical Draft and for Blowing and Exhausting.

A Bulletin illustrating and describing Sirocco Fans will be mailed to you at your request.

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Montreal

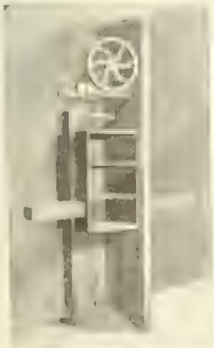
E. C. POWERS
43 Victoria St.,
Toronto

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

Sales Engineers

W. P. EDDY
301 Tribune Bldg.,
Winnipeg

S. S. CLARKE
605 - 2nd St.,
Calgary



No. 1 BAND BRAKE DUMB-WAITER
40 to 150 lbs. capacity

CHELSEA

EXEMPLAR OF QUALITY

DUMB-WAITERS

[illegible]

[illegible]

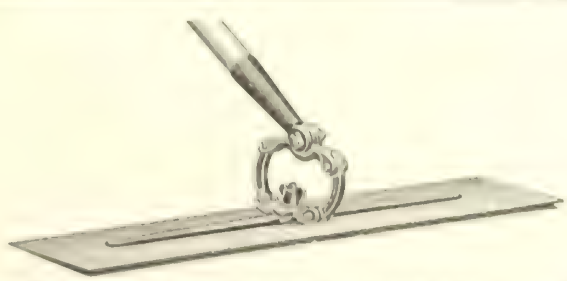
Chelsea Elevator Co.

NEW YORK

Agents

Hardware Co. of Toronto,
Limited

26 Adelaide St. W.



"Abram" Sidewalk Finishing Tools are sold on the **Guarantee** that **ONE MAN** can do more work with them than **THREE MEN** can do with ordinary tools. This means, if finishers get $4.00 per day, you save the wages of **TWO MEN**, or $8.00 per day, by using **"Abram"** Tools. We positively guarantee this result. Let us prove it to you. [illegible]

ABRAM CEMENT TOOL CO. 105 Ouellette Ave.
WINDSOR, ONT.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140, tapestry brick, $20 to $30; sandlime brick, $8.10. King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$4.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 65c.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals). Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; Bsitish manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

(Continued on page 72)

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Plain Round, Square and Cold Twisted Squares

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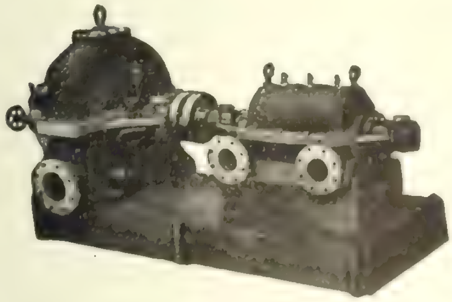

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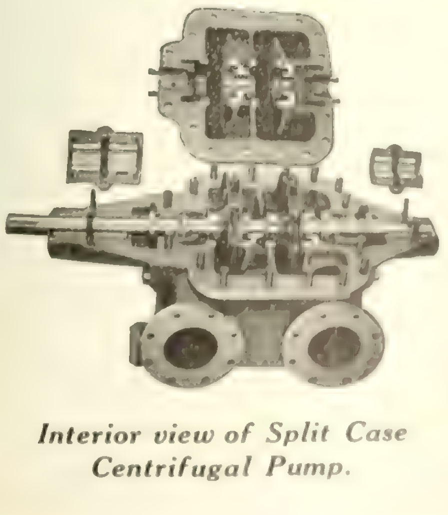
Hill-Tripp Pumps have many superior features not found in other makes. By patented design of the casing and impellers all end thrust is eliminated. No high velocity water comes in contact with the casing. Impellers are non-overloading and the pump runs noiselessly at all heads and speeds.

The casing is split, allowing access to the interior without disturbing the pipe connections. Built for all capacities and heads and with from one to six stages.



Interior view of Split Case Centrifugal Pump.

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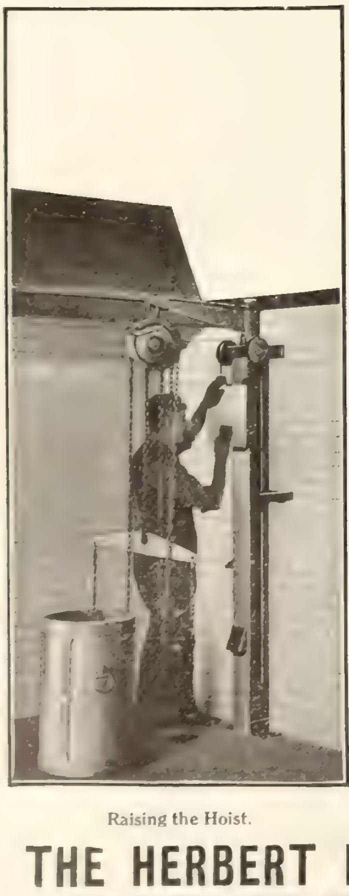

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SPEED The load is lifted at 30 feet a minute.
EASE All gears machine cut and accurate.
SNUG Occupies little space when not in use.
STOCK We stock complete hoists and spare parts

The Morris Telescopic Basement Hoist is used for lowering coal, barrels, ice, trunks, cases, etc., into the cellar of hotels, schools and public buildings, and for the removal of ash-cans and garbage-cans. It enables one man to do safely and comfortably what formerly was a risky and heavy task for two. The separate lifting gear can also be used for many other purposes around the building. The Jib-Head swings round to deposit its load right on the sidewalk.

When not in use all parts are below the sidewalk level, free from interference and causing no obstruction.

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It appeals to the Architect as a complete solution of the problem, to the Owner as a stock article, reasonable in price and a labor saver, to the Janitor as a quick way through many a rough job.

Lifting the Ash-can.

THE HERBERT MORRIS CRANE & HOIST COMPANY, LIMITED,

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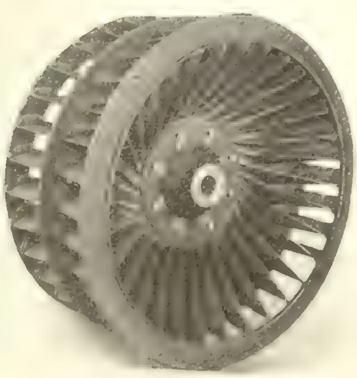

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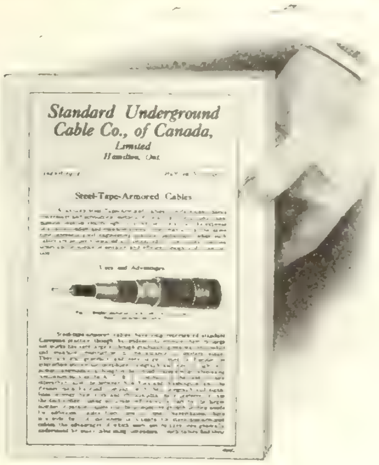

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The group of business men interested in promoting Herringbone sales expect the increase in the volume of business to compensate them for the decreased profit per yard. This increase can only result from a definite improvement in Herringbone quality. They therefore demanded the most searching tests before adopting the new policy.

These tests consisted of seventy-five quantitative measurements of actual corrosion of plain steel bedded in hard wall plaster as compared with seventy-five identical tests on copper alloy. Five different brands of plaster were used. The time tests were continued until corrosion on copper alloy (but not on plain steel) had ceased. The average of all these tests showed that copper alloy is sixty-one per cent. more efficient than plain steel in resisting hard wall plaster corrosion. Ask for the booklet "Why Copper Alloy."

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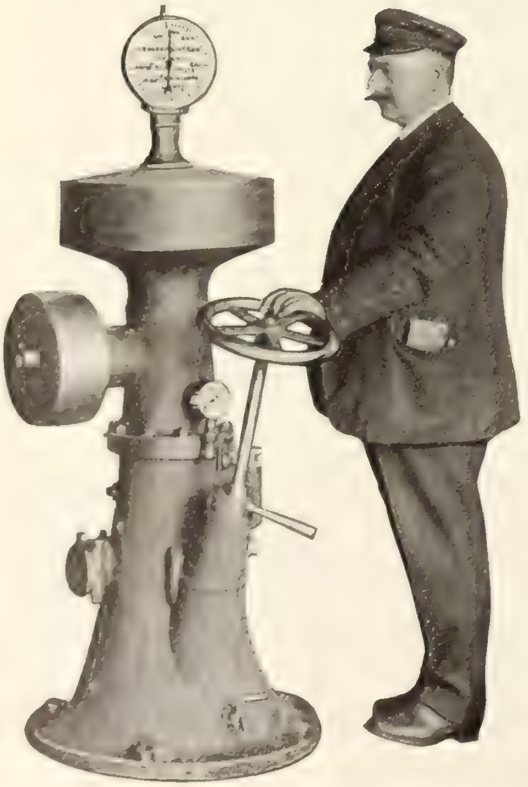

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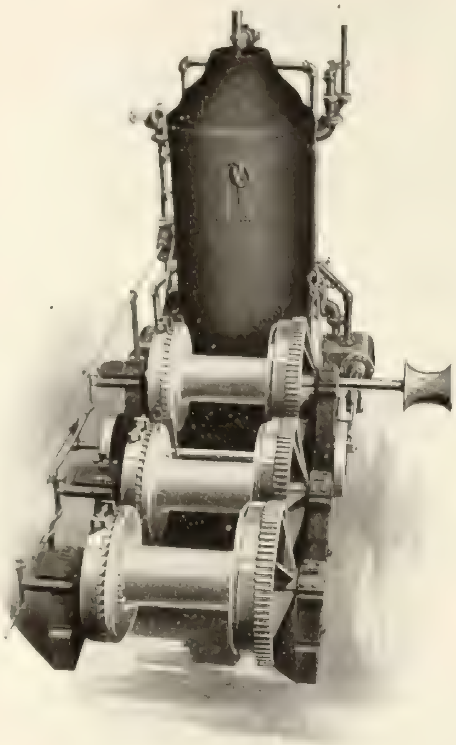

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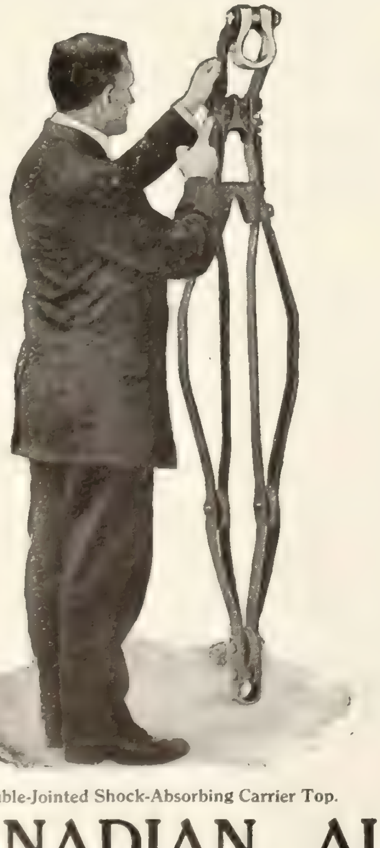

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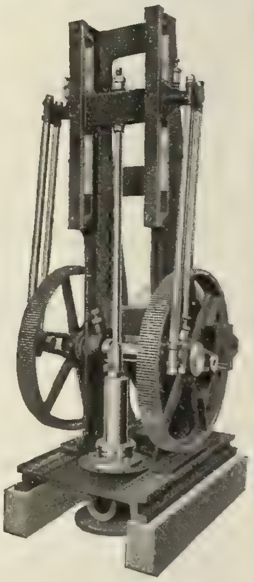

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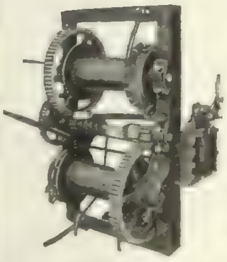
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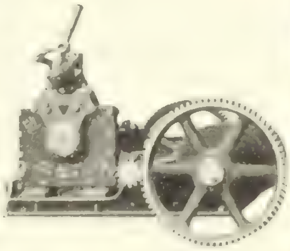
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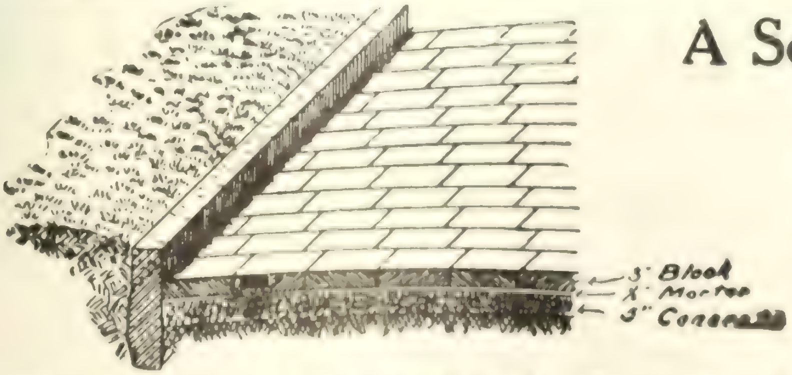

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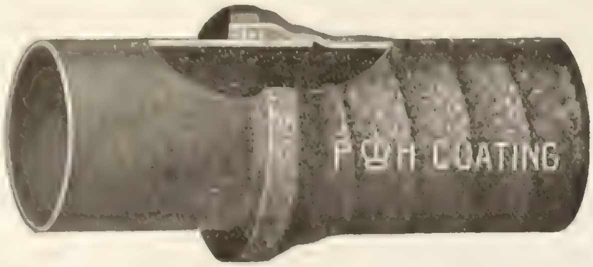

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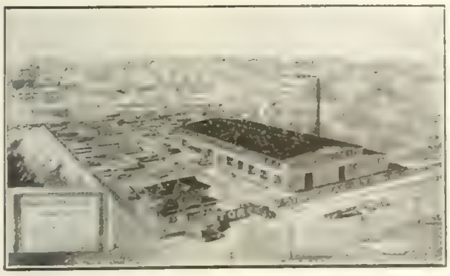

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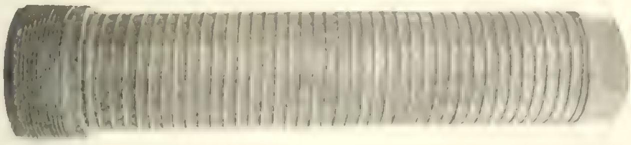

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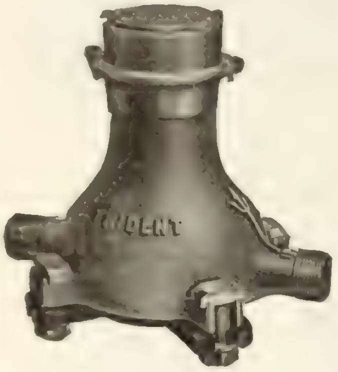

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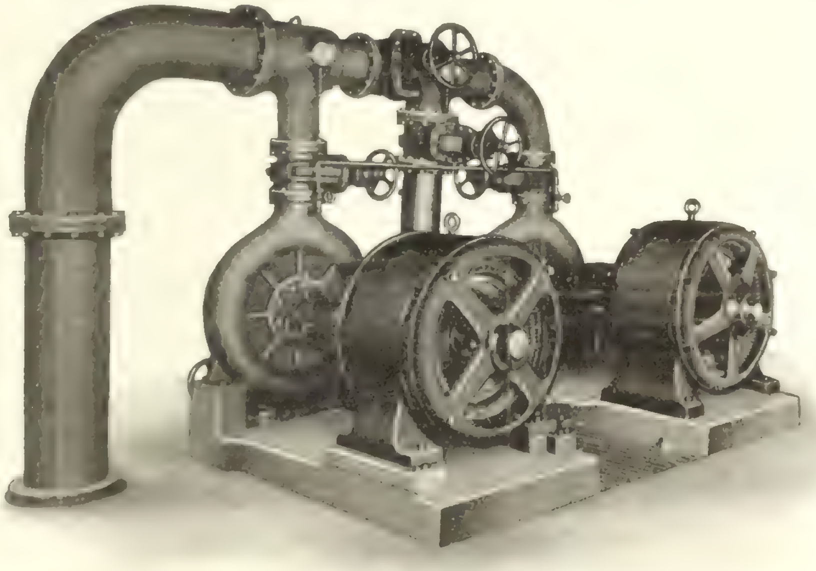

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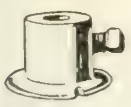


Fig. 1

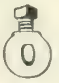


Fig. 2

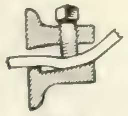


Fig. 3

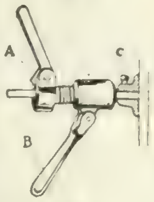


Fig. 4

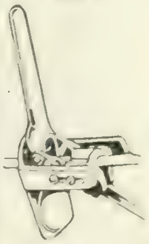
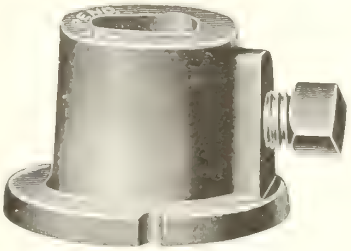


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section, showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally [illegible] in its application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

Universal Form Clamp Co.

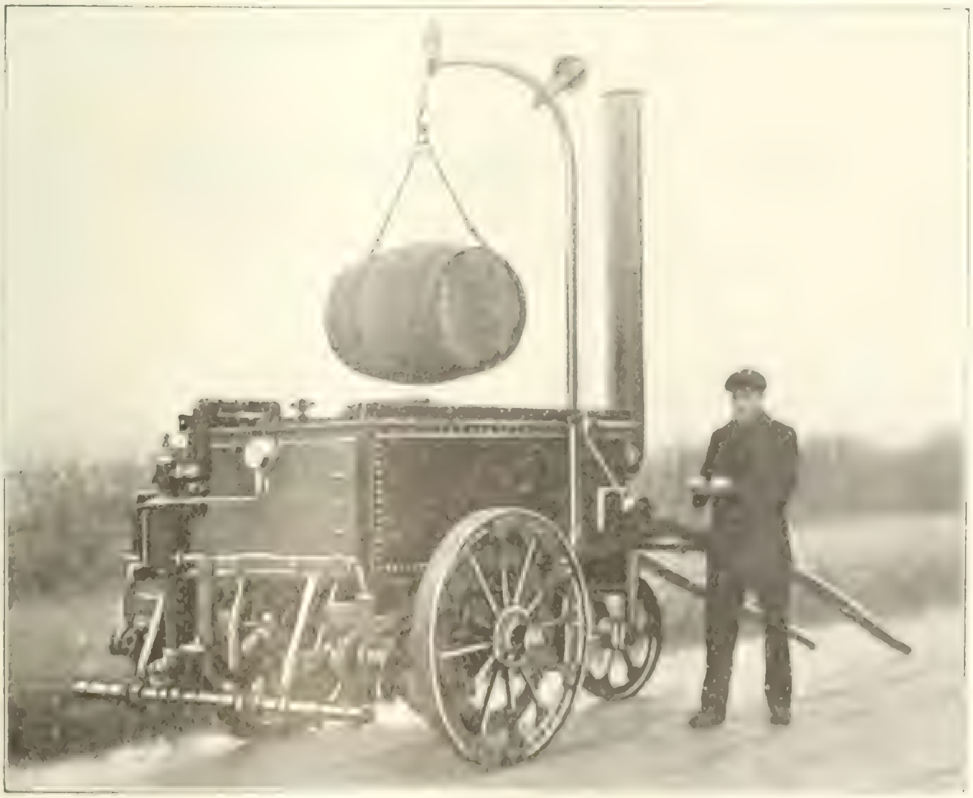
Sole Representatives for Ontario and Eastern Canada:

Railway Contractors Supply Company

504 Standard Bank Bldg., Toronto

Montreal representatives—Ramsey & Kelly, 511 Quebec Bank Bldg.

Universal Form Clamp Co., 504 Standard Bank Bldg.,
Toronto
I enclose 10c. Please send me a sample
Universal Clamp.
Name
Address



For Surface Treatment of Roads the

TAROADS

patent Machines are far in advance of any other Tar Spraying apparatus on the market for

Efficiency
and
Expedition

(penetration assured.) They are capable of DOUBLE the output of all other machines.

Write for illustrated folders.

Cables
TAROADS — LONDON

TAROADS SYNDICATE, LTD.

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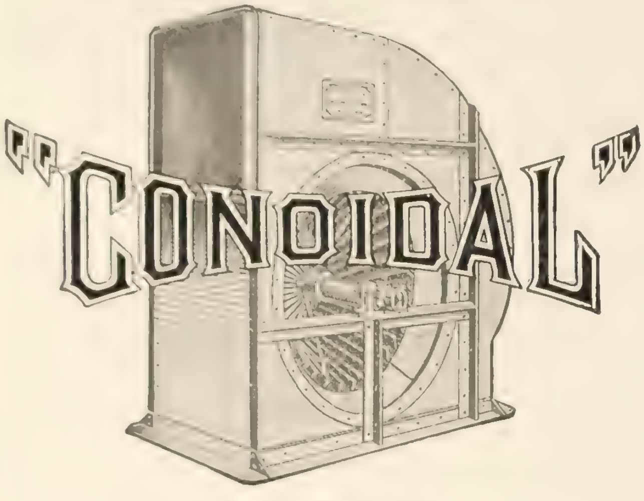
9 VICTORIA STREET
WESTMINSTER, LONDON, Eng.

BUFFALO



FANS

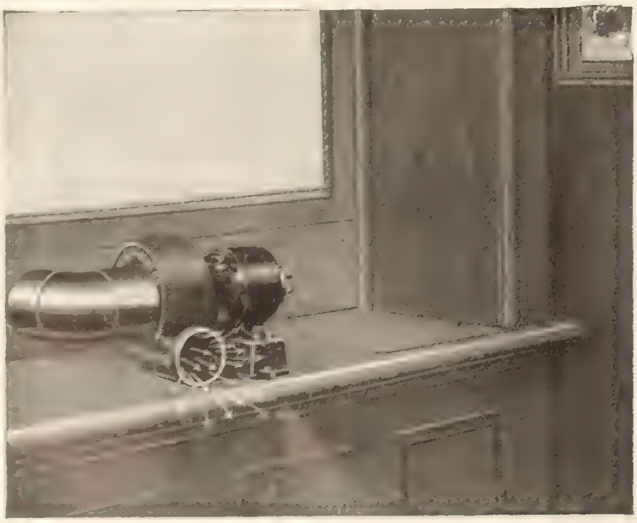
Did you ever stop to consider that there is as much difference between fans as between people? THE BUFFALO "CONOIDAL" FAN HAS AN INDIVIDUALITY OF ITS OWN.

The various features of the conoidal design, including the cone inlet, the shape and angle of the blades at heel and tip, and the conical form of the inner and outer edges, insure a minimum loss by shock, the least noise in operation, and the highest efficiency obtainable in multivane fans.

All sizes for all conditions down to the small Baby Conoidal but 9-in. high for general ventilating purposes.

Every fan user should have a copy of our Catalog No. 199-12.

CANADIAN BUFFALO FORGE CO.
BERLIN, ONT. Limited
ST. JOHN, MONTREAL, TORONTO, WINNIPEG, VANCOUVER.



Do You Think

that you can Afford

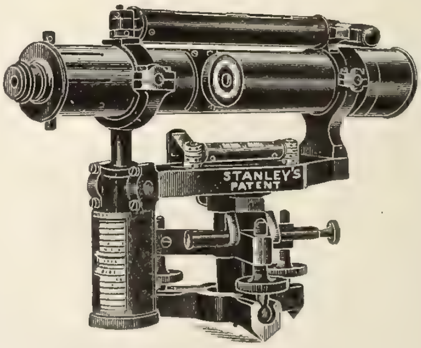
to pass us by before getting our prices on your requirements or before putting in your tenders on

Plate Sheet Fancy
or any kind of
Glazing Glass

The
Consolidated Plate Glass Co.
of Canada, Limited

TORONTO MONTREAL WINNIPEG

TRADE **STANLEY** MARK



Stanley's Gradiometer saves much time in Railway and Drainage Works. Can be divided to read either ordinary or percentage gradients. Illustrated pamphlet on application.

The Largest Manufacturers of Surveying and Drawing Instruments in the World.

Drawing Office Stationery of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our catalogue "K 91" and compare our prices with those of other *first-class* makers.

W. F. Stanley & Co., Limited
286 High Holborn, LONDON, ENGLAND

From generator
to consumer
you should install
reliable

Northern Electric Wires and Cables

In the largest wire plant in Canada—under the Northern Electric trade mark and guarantee is manufactured *every type* of wire and cable, including

High Tension, Lead Covered Paper Insulated, Power Cables

Northern Electric Wires and Cables are the most carefully made—the most rigidly tested—the most universally satisfactory transmission in use to-day. From raw material to finished product the skilled workmanship of our operatives is ***continuously*** supervised and inspected. Electrical engineers whose reputations have been made on exacting work of great magnitude, use Northern Electric Wires and Cables.

One order recently received from the Montreal Light, Heat and Power Company and another from the Cedars Rapids Manufacturing & Power Company together constitutes the largest single order ever placed for lead covered high tension power cable. The first mentioned concern has more underground cable installed than any other public service corporation — and its Engineers ***know*** Northern Electric dependability from comparative tests ***in service.***

The Northern Electric line includes:

Cable Terminals,
Compounds, Junction
Boxes and other accessories

Write for data on any wire or cable problems that confront you.

Northern Electric Company
LIMITED

MONTREAL WINNIPEG EDMONTON
HALIFAX REGINA VANCOUVER
TORONTO CALGARY VICTORIA

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

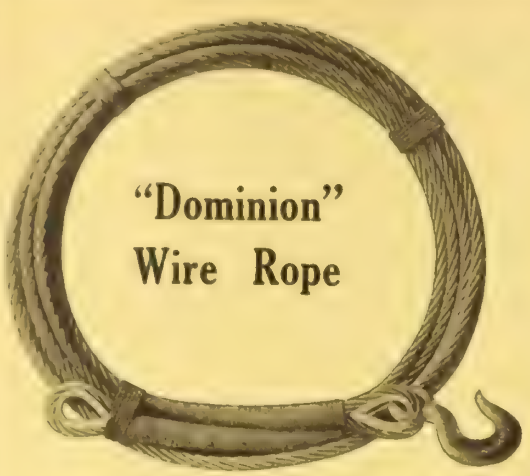
This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally located at Adelaide and Charlotte Streets.
- Light on four sides
- Passenger and freight elevator
- Vaults
- Low insurance
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West, Toronto
Phone Adelaide 2700



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths of wire rope for **Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.**

We manufacture special ropes to take care of your particular needs.

Wire Rope Fittings, Blocks, Clips, Etc., in stock

THE DOMINION WIRE ROPE CO., Ltd.
MONTREAL

"Industrial Works"

Locomotive-Coaling and Wrecking

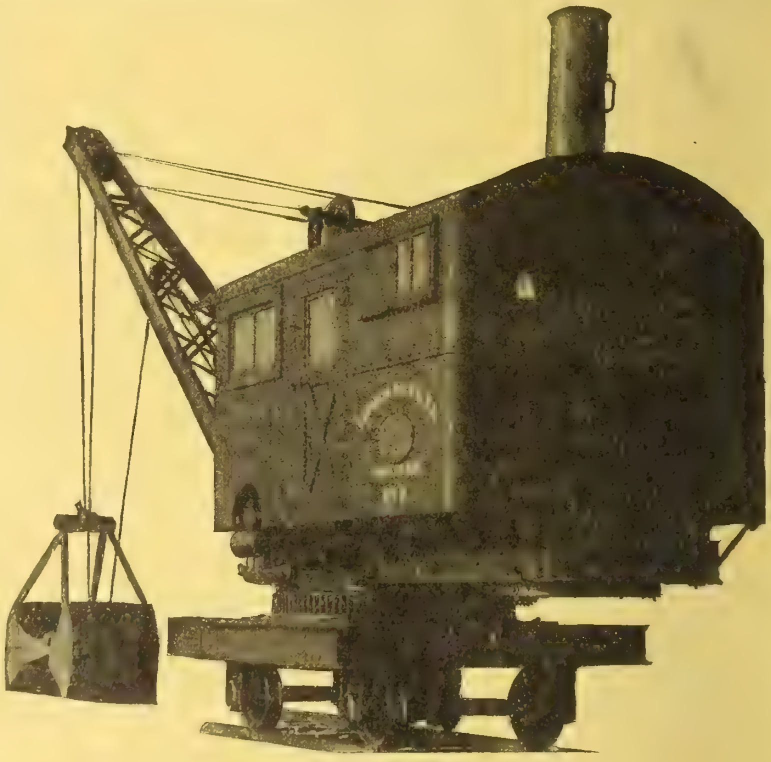
CRANES

In capacities from 5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request.

We supply Contractors' Equipment of all descriptions.

F. H. HOPKINS & CO.,

HEAD OFFICE
MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, October 28, 1914 No. 43

Contract Record and Engineering Review

ESTABLISHED 1886

MADE IN CANADA
BENT GLASS
THE TORONTO PLATE GLASS IMPORTING CO. LIMITED
TORONTO

GLASS BENDERS
TO THE TRADE

THE TORONTO PLATE GLASS
IMPORTING COMPANY LIMITED
GLASS IMPORTERS AND MANUFACTURERS
91-113 DON ROADWAY, TORONTO

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

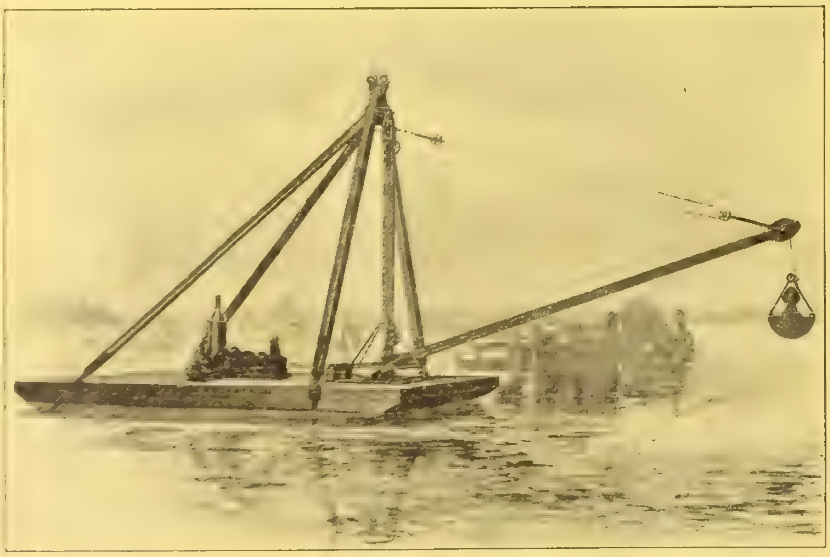
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

"I Don't Believe It Would Be Possible To Build A Better Barge Derrick."



That's the opinion of one man who has been using an

"AMERICAN" BARGE DERRICK

since early last spring.

The mast is set forward of the "A" frame, permitting the boom to swing a full half circle.

The new design-gudgeon pin socket provides play enough to take up all strains caused by swaying of barge. No more bent or broken gudgeon pins.

Derrick irons are heavier than usual and better finished.

Stiffleg and "A" Frame fastenings to barge are pin and clevis type. That means not only the safest and strongest possible fastening, but also the easiest to install.

The engine installation is subject to operating requirements. One thing is certain; it will be fully up to the quality of the rest of the equipment.

American Hoist & Derrick Co., St. Paul, Minnesota

SOLD BY—General Supply Co., of Canada, Ltd. Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

28 "Service" Branches
Throughout Canada

Canadian Consolidated Rubber Company, Limited

Montreal, P. Q.

"Business As Usual"

We have not, owing to the war, shut down any of our plants, discharged any of our workmen, reduced their hours of labor or cut their rate of pay.

We are doing "BUSINESS AS USUAL."

We intend to continue this policy to the extent of our ability, and, to that end, suggest that you confine your purchases, during the war and thereafter as largely as possible to goods "MADE IN CANADA."

When in the market for Rubber goods of any description—Belting, Hose, Packing, Tires or anything else—write or wire our nearest Branch for prices and information.

It is our desire to serve you.

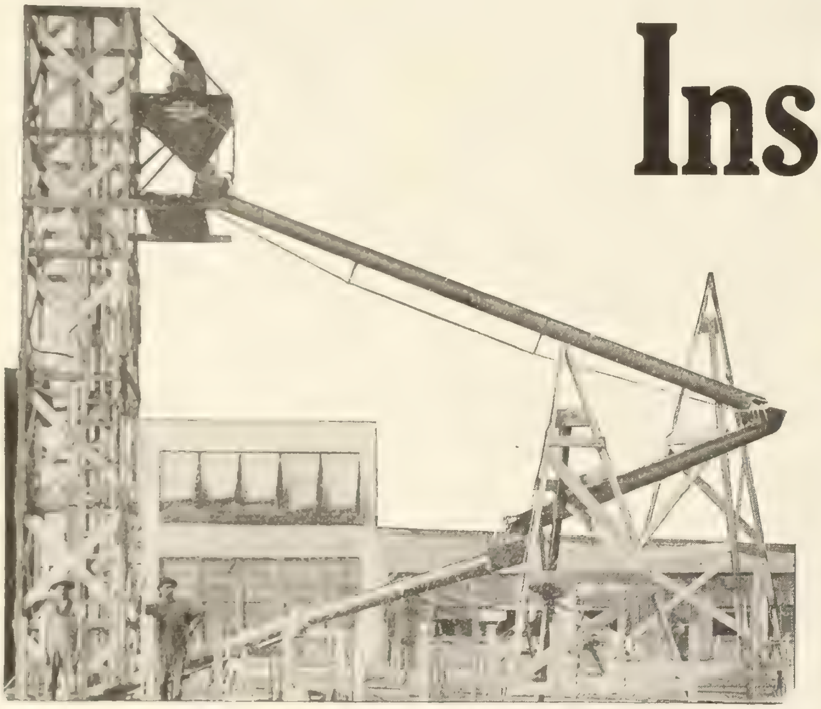
"Business As Usual"

Canadian Consolidated Rubber Company, Limited

Montreal, P. Q.

28 "Service" Branches
Throughout Canada

Spout Your Concrete



Insley Chutes

will materially reduce the cost of getting concrete from the mixer to the forms.

Maintain the concrete uniformly in the same homogeneous state—the concrete as it flows from the discharge end is better mixed than when it left the mixer.

Used on buildings with a few hundred yards of concrete, and by the largest contractors on the most important work undertaken.

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TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

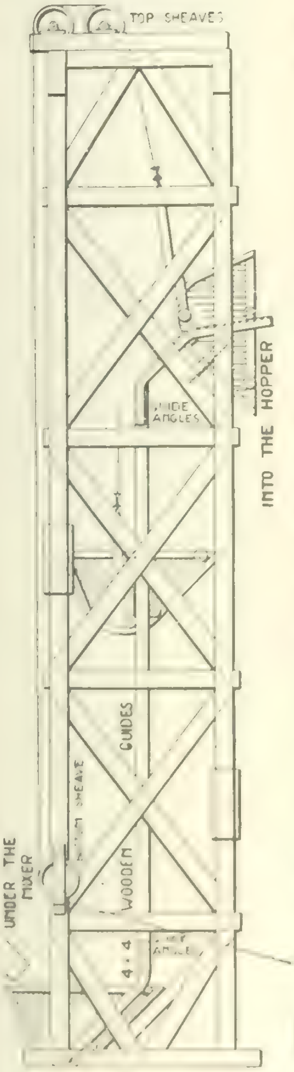
ECONOMY

In First Cost—Saving in Time

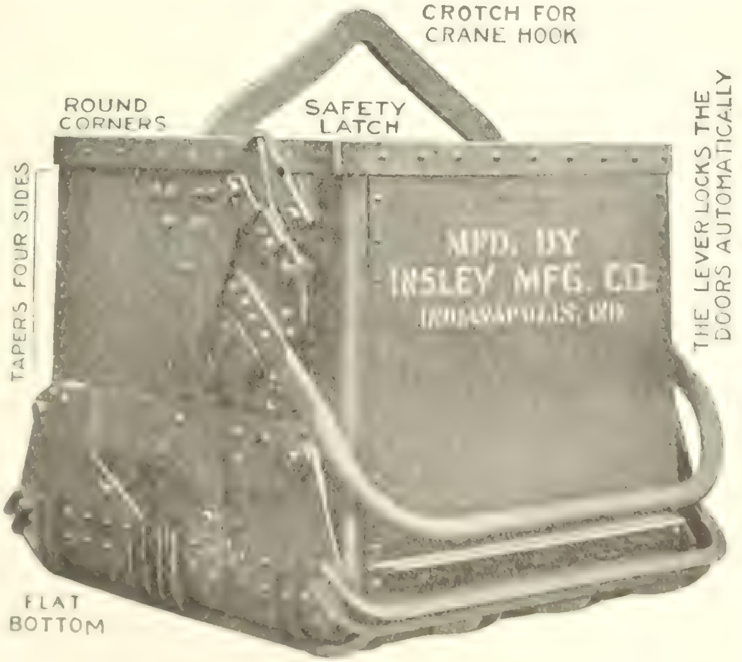
Saving in Operating Cost

are the reasons for installing

Insley Equipment



Concrete Spouting Plants, Hoists, Towers, Hoppers, Cars, Buckets, and Spouting, Concrete Hand Carts, Spreader Carts, Tip-Over Carts, Column Clamps, Monarch Bottom Dumping Buckets, Slack-Line Excavator Plants, Drag-Line Buckets, Car Side Hoppers, Stone Skips, Cable-Way Skips, Etc., Etc.


CROTCH FOR CRANE HOOK
ROUND CORNERS
SAFETY LATCH
TAPERS FOUR SIDES
THE LEVER LOCKS THE DOORS AUTOMATICALLY
MFD. BY INSLEY MFG. CO. INDIANAPOLIS, IND.
FLAT BOTTOM

CATALOG ON REQUEST

Mussens Limited

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WINNIPEG, 259-261 Stanley Street
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VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
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- Cement Gun Company

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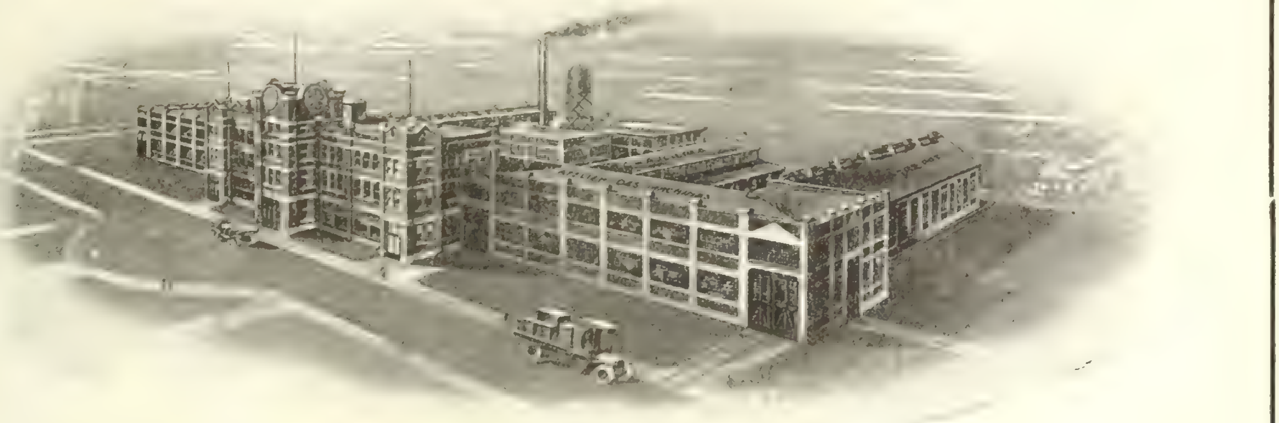
(Continued on page 12)



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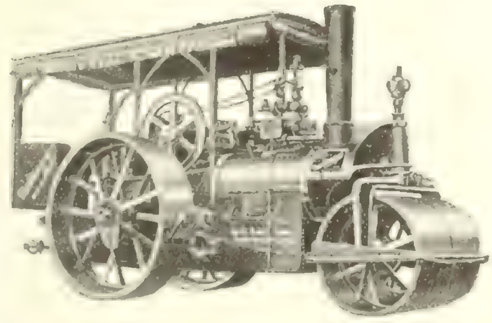
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The **"Montmagny"** line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



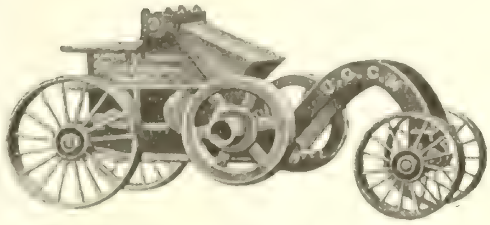
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature
"Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

THE NORTHWESTERN TERRA COTTA COMPANY

C. P. R. OFFICE BUILDING
Darling & Pierson, Architects

DOMINION BANK BUILDING
Darling & Pearson, Architects

Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickle Steel Castings

Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 inches in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.

The European Crisis

does not affect the delivery of

London Concrete Mixers

Our policy is

"Business as Usual"

The London Concrete Mixer is the equal in all respects of any Mixer manufactured outside Canada. There are more than 1,200 London Mixers in use in Canada—also many in Foreign Lands. All steel construction and built like a Dreadnaught. Guaranteed for life. Made in twenty-three sizes and fitted with any equipment.

SUPPORT HOME INDUSTRIES

We are the Largest Manufacturers of Concrete Machinery in Canada.

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory: Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:

Winnipeg, [illegible], Manager

Calgary, [illegible], Manager

Halifax, [illegible], Manager

AGENCIES:

Vancouver, B. C. Equipment Co.

Montreal, P. Q.—Foss & Hill Machinery Co.

Fort William and Port Arthur, [illegible]

Ottawa, [illegible]

A TALK ON CONCRETE

School Building, L'Epiphanie, Que.
Architects—Viau & Venne, Montreal.

What architect or contractor is not alive to the possibilities of concrete, especially if it can be used as a decorative building material?

The progress of concrete has now entered the brick field, and is, we believe, there to stay. We have backed up this belief by erecting a brick plant, the equal of which cannot be found on this continent; and we are shortly to establish ten of these plants throughout the Dominion. Each unit has a capacity of from thirty to forty thousand CONCRETE BRICK per day, OUR PLANT AT MASCOUCHE, QUE., IS RUNNING TO FULL CAPACITY. Particularly at this time this fact speaks for itself, and needs no enlarging upon.

There is no material made anywhere that can compete with this product. This fact is clearly demonstrated when one realizes that a brick, CONCRETE THROUGHOUT, can be made in any shade or color, is waterproof, fireproof, and perfect in shape and coloring. The durability of concrete is universally known and recognized and needs no comment here.

If you have not seen this brick make it your business to do so. It will be your loss if you do not. Our plant is open to inspection. Red, pearl grey, and buff brick can be had for immediate delivery, or any color made to order. Formal enquiries regarding prices, etc., given prompt attention.

"A Perfect Material—A Perfect Brick"

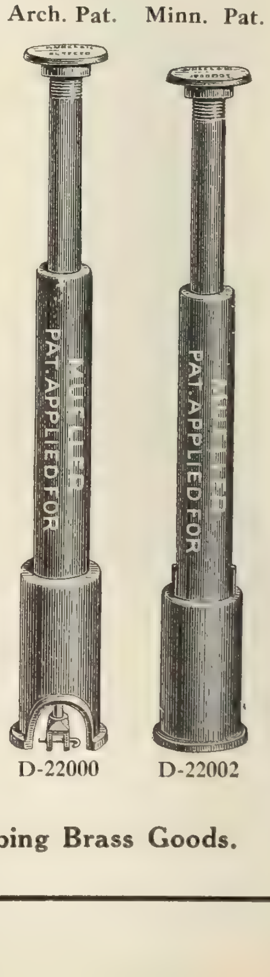
MADE IN CANADA

National Builders' Supply & Enamel Concrete Brick Co., Limited

Montreal Office: 30 St. Francois Xavier St. **Plant: Mascouche, Que.**

Canadian Soil is Full of Mueller Service Boxes

And every user is getting the very best results possible and is entirely satisfied, because his service box troubles are over.



Mueller Extension Service Boxes

Have solved a vexatious problem for many waterworks men and municipalities.

They are **vandal proof** and **dirt proof**. Experts designing these boxes successfully overcame the many objections previously made to service boxes in use. Made in Arch and Minneapolis pattern.

The Mueller Service Box is perfect. We invite your investigation. Clip and mail the coupon today.

"Made in Sarnia"

H. Mueller Mfg. Co., Ltd.

SARNIA, ONTARIO

Makers of high grade Water, Gas and Plumbing Brass Goods.

**H.
Mueller
Mfg. Co.
Ltd.
SARNIA, ONT.**

Send me your booklet on Service Boxes.

Signed ....

City...... ......Prov.............

Universal Form Clamp

Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

Railway Contractors Supply Co.
Standard Bank Building, Toronto
Agents for Ontario and Eastern Canada

—Montreal representatives—
RAMSEY & KELLY, 511 Quebec Bank Building

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

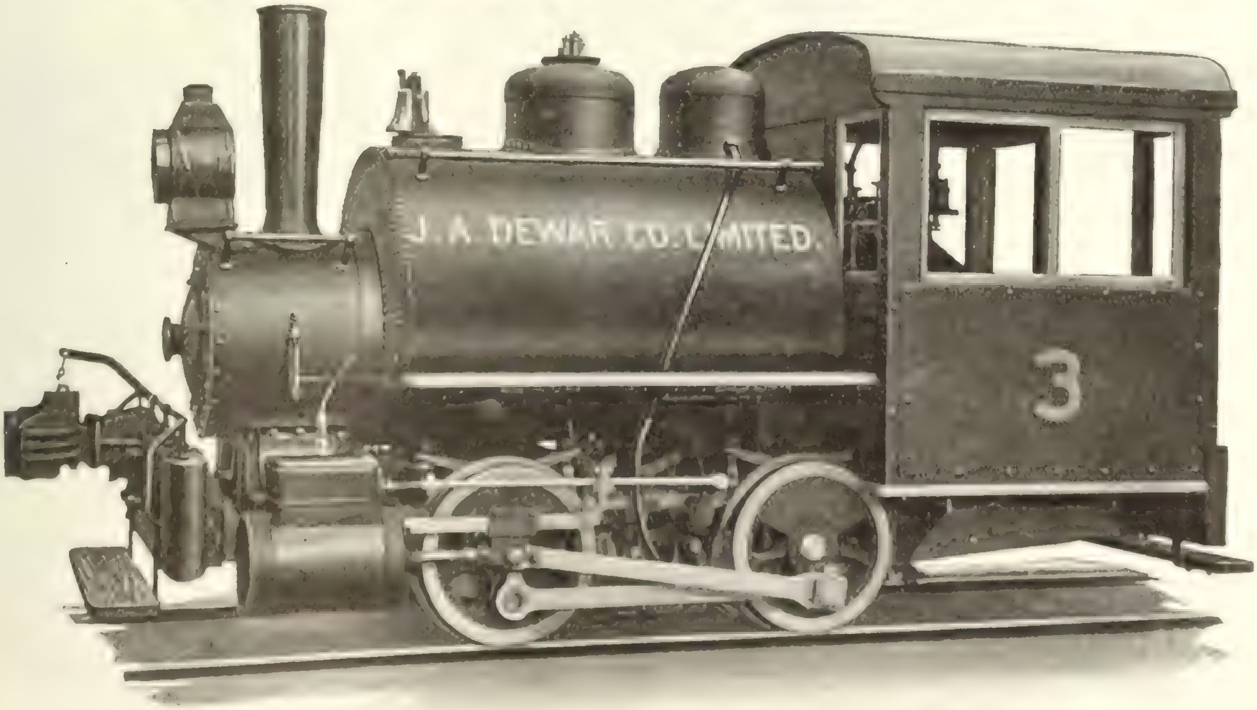
They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of teriffic usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design — special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for expeditious shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA
TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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Drop Forgings
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  Chipman & Power.
  Dominion Engineering & Inspection Company
  Farmer, John T.
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  Lea & Ferguson
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Excavators
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  Brown Hoisting Machinery Co.
  Canadian Equipment Co.

Exhaust Heads
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  Sheldons Limited

Expanded Metal
  Pedlar People Limited

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  Canadian Sirocco Company
  Sheldons Limited
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  Can. Consolidated Rubber Co.

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  Gurley, W. & L. E.

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  American Water Softener Co.

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  Ontario Lime Co., Ltd.
  Smyth & Ryan

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  McGregor & McIntyre

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  Frontenac Floor & Wall Tile Co.

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  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

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Gasoline Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.
  Mills Bros.

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  Consolidated Glass Company
  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co.

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  Canadian Ingersoll-Rand Co.

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  Boving Company of Canada
  Pittsburgh Valve, Foundry & Construction Company

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  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
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  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock and Power Machinery
  Royce Limited

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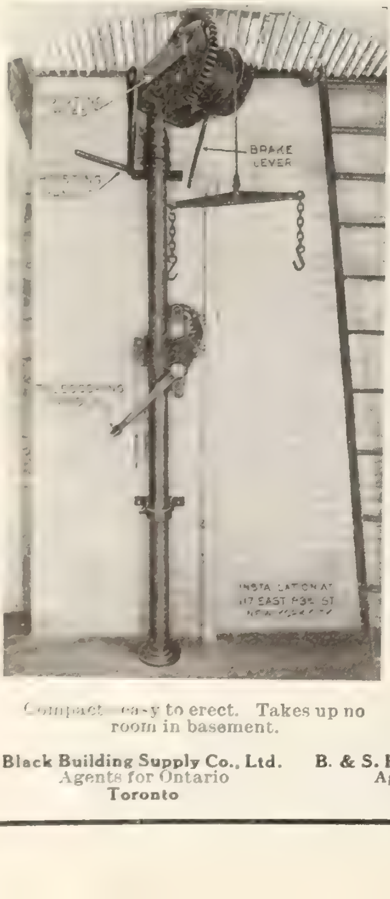
G & G TELESCOPIC HOIST (PATENTED)

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.



Compact, easy to erect. Takes up no room in basement.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Gillis & Geoghegan

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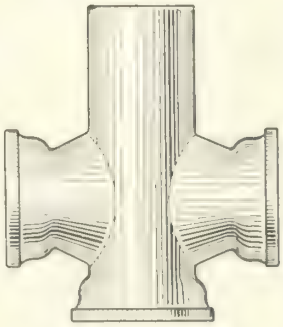
Agents for British Columbia
Vancouver

Warren

Cast Iron Pipe

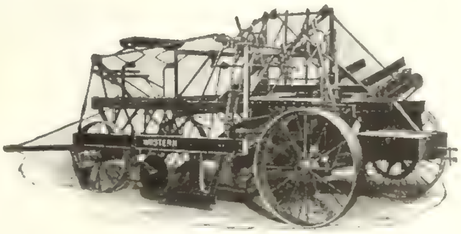


Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

Large stocks always carried on hand.
Prompt shipments.

Warren Foundry and Machine Co.
11 Broadway - NEW YORK

Western Elevating Graders for Wagon Loading



They are invaluable. Will load earth into as many as three 1½-yd. wagons per minute and one hundred per hour. A big saving over the old-style hand loading. Western Elevating Graders are simple in construction and economical in upkeep. They are built for day-in-and-day-out service. Every one that is interested in Road Work, Excavating Canals and Ditches, Building Levees and Embankments, should get full details in our illustrated catalog.

Western Wheeled Scraper Co.
Earth and Stone Handling Machinery
AURORA, ILLINOIS
Dominion Equipment & Supply Co., Winnipeg, Calgary, Edmonton
Agents for Manitoba, Saskatchewan and Alberta
Canadian Equipment Co., Montreal, Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Roelofson Elevator Works
- Northern Crane Works

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- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

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- Standard Underground Cable Co. of Canada, Limited

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- Steel & Radiation Ltd.

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- Neptune Meter Co.

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- Canadian Pipe Co.
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- Warren Foundry & Machine Co.

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- Ontario Lime Co., Ltd.

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- Excelsior Plate Glass Co.
- Pilkington Bros.

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Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron
Plain Black Iron
Galvanized Iron
V-Crimped Roofing
Metal Siding
Valleys
Conductor Pipe
Eave Troughs
Culverts

Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

Sarnia Metal Products Company, Limited
Sarnia, Canada

Storage Bins, Capacity 2000 Tons

Crushed Stone

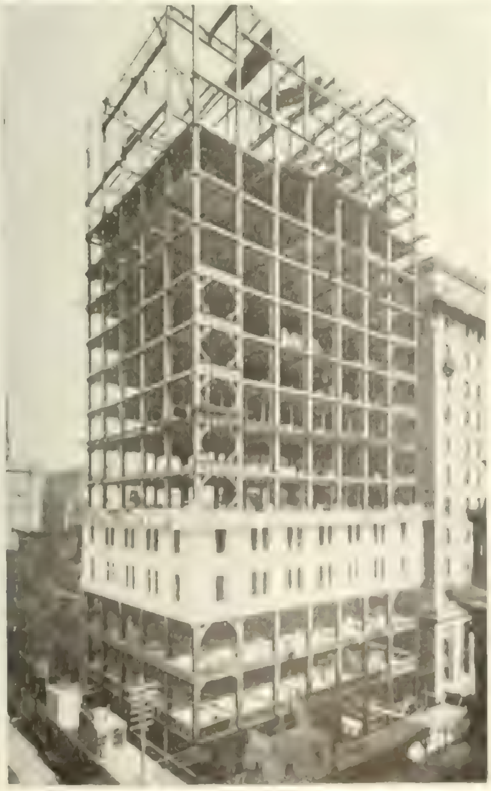
All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario



Canadian Pacific R. R. Office Building
Dominion Bridge Co. Steel Fabricators
Structural Steel Painted with
"SUPERIOR GRAPHITE PAINT"

The Structural Steel of

The Highest Commercial Building

in the British Empire

is protected by

"SUPERIOR GRAPHITE PAINT"

The use of this Paint absolutely insures steel against damage by Rust or Electrolysis.

SPECIFIED BY LEADING ARCHITECTS

Because it has Twenty-five years of **proven** service to its credit.

Made only by

DOMINION PAINT WORKS, LIMITED

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McDougall Caledonian Iron Wks.
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McDougall Caledonian Iron Wks.
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Vancouver Wood Pipe & Tank Company
Walsh Plate and Structural Wks.

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Northern Electric Co.
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Greening Wire Co., B.

Wire Rope
Canada Wire & Cable Co.
Greening Wire Co., B.

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Canadian Billings & Spencer, Ltd.

Champ de Mars, Montreal, Que. Tarvia pavement.
(A Soldiers' Parade Ground, surrounded by Municipal Buildings of the City of Montreal.)

What France thinks of it!

M. Thierry, Minister of Public Works of France, has announced a determination to put a tar coat on 6,000 miles of the splendid highways for which France is famous.

The cost will probably be not less than $50,000,000.

According to a special cable dispatch to the Philadelphia Ledger — "M. Thierry is convinced that the only way to combat the wear and tear is to undertake systematic tarring of the road."

It is intended to make France a paradise for automobilists. A new Tourist Department has been created under M. Thierry's direction to grapple with the problem of overhauling the roads for the benefit of motor traffic.

Ever since Napoleon put through the great military roads the French road engineers have been foremost in their profession, and their preference for tar (or Tarvia, as it is called in this country) is a signal tribute to the efficiency of this road binder.

Tarvia is dense, viscid and waterproof. It encloses the stone in a tough and slightly plastic matrix. A tarviated surface sheds water instantly without forming mud, and is automobile-proof. Automobile wheels moving at speeds which are destructive to ordinary macadam simply act as rollers on the tough, plastic tarviated surface.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N.B. HALIFAX, N.S. SYDNEY, N.S.

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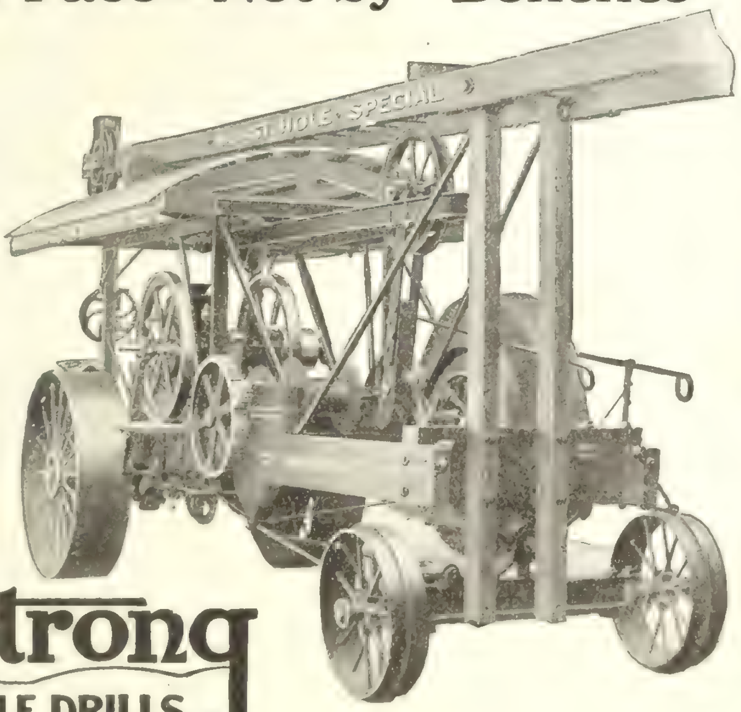

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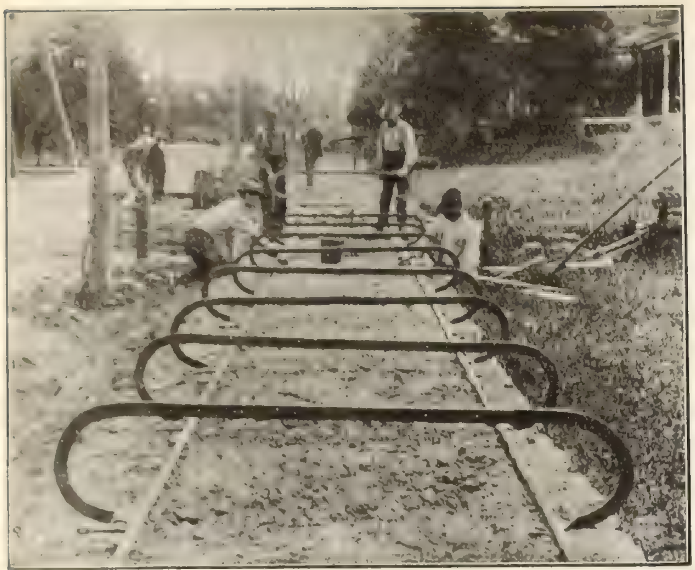

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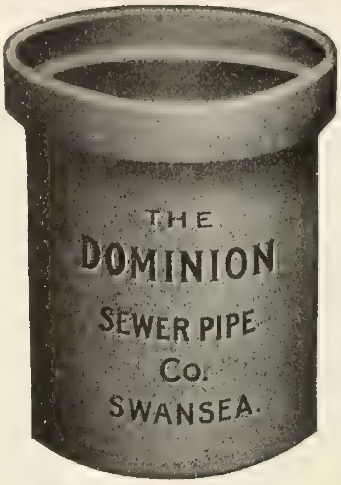

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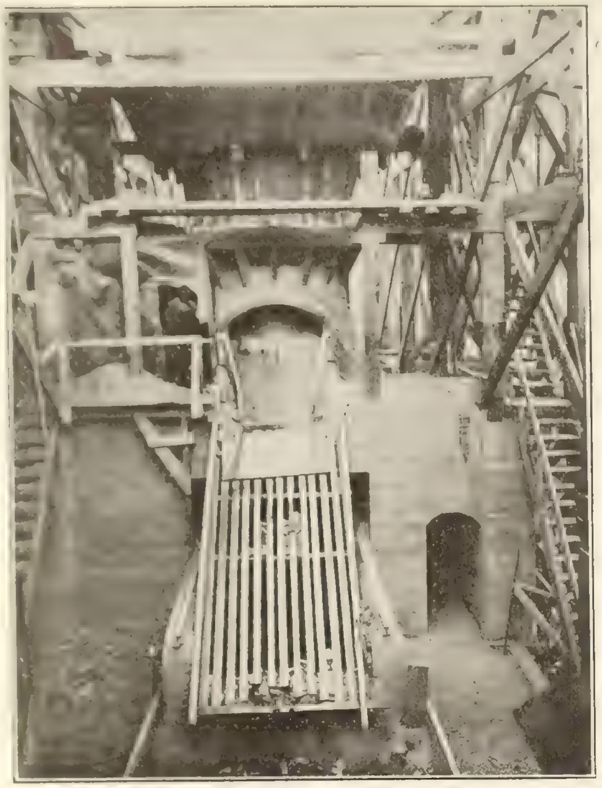

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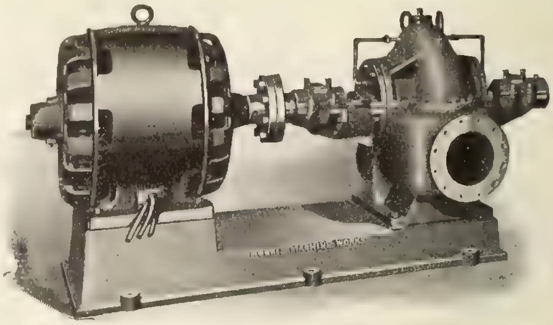

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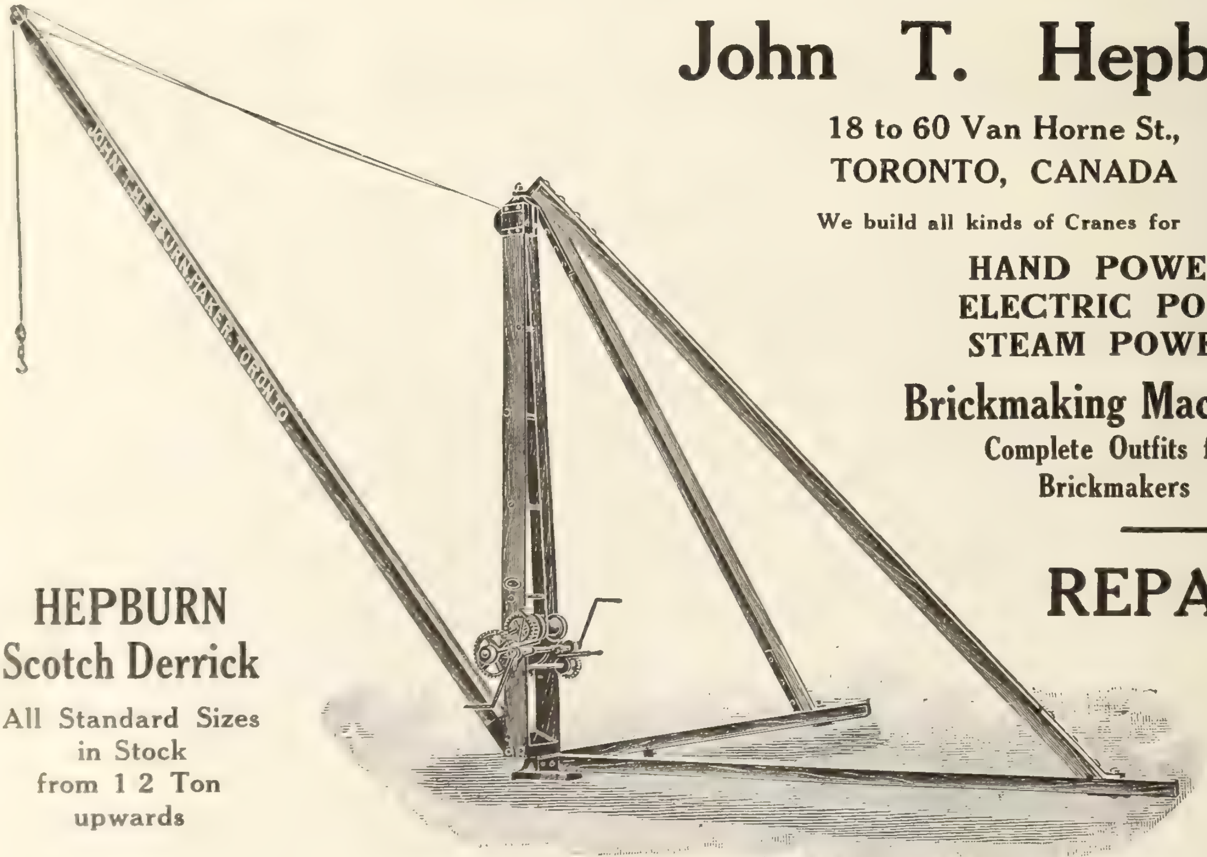
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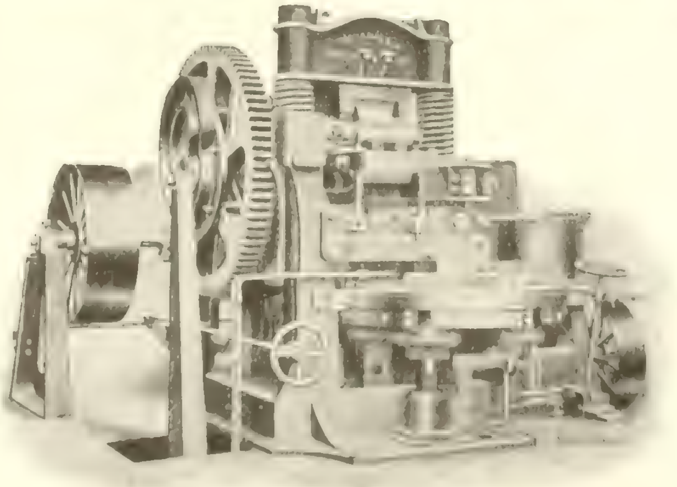

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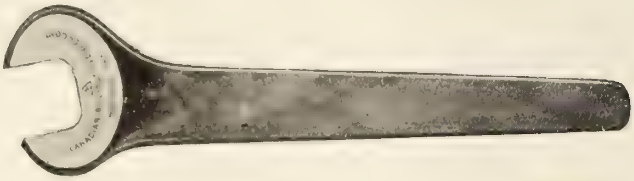

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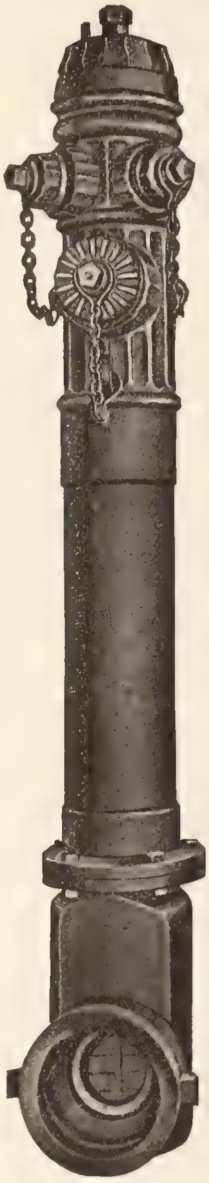

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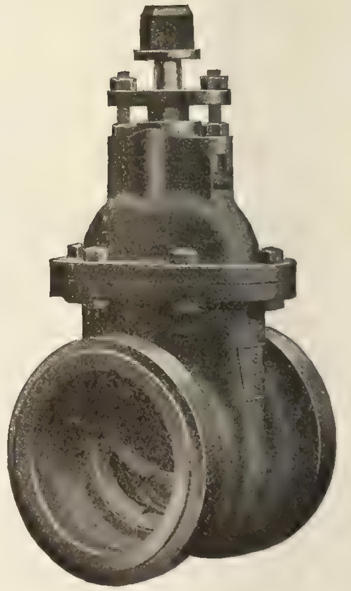

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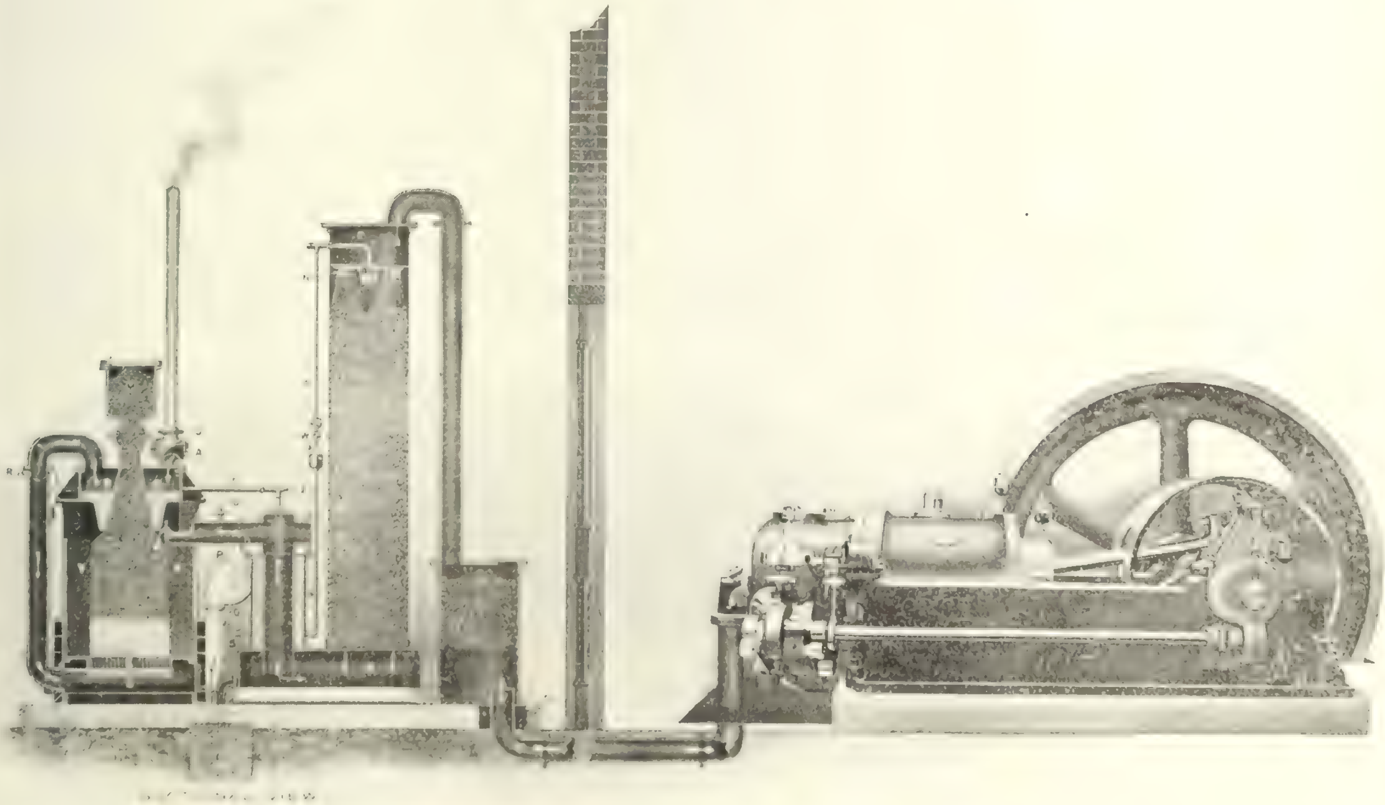
For Operating on Suction, Town or Natural Gas



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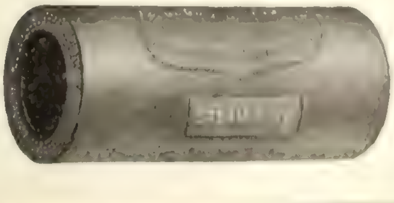

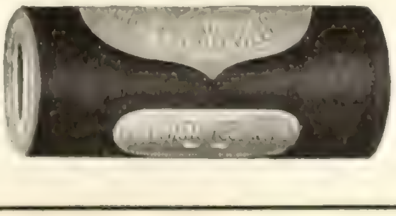

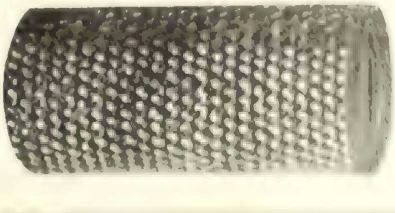

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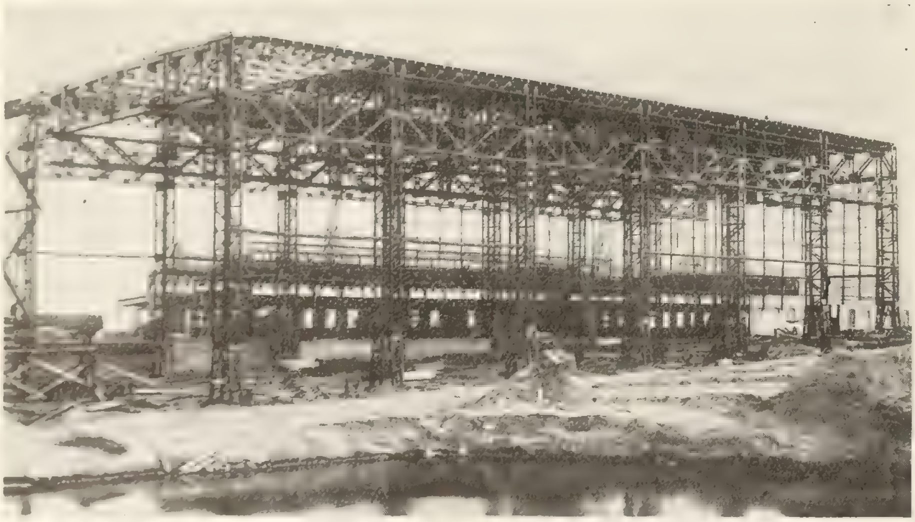

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An Argument in Hard Facts

CANADA is beginning to pick up some of the trade which may be said to have been occasioned directly by the war. Hon. Robert Rogers is responsible for the statement that not only Great Britain, but France and Russia, are placing, or preparing to place, orders which involve the expenditure of millions of dollars. Already contracts have been received from France and Russia for 35,000 saddles, while Great Britain has ordered 10,000 and Canada an additional 10,000. In addition, orders have been placed for some 6,000 sets of harness. Assurance has been received from the British Government that large orders for supplies will be placed in Canada, and already contracts for blankets and shirts to the value of $7,000,000 have been placed. "Canadian-made goods will get such a showing in the markets of France and Russia," says Hon. Robert Rogers, "that Canada should easily become the first nation in exporting to those countries."

In regard to the commercial future of Canada, Mr. Rogers is most optimistic. "With immense orders coming in from the allies," he states, "the industrial output of the Dominion will be well maintained and the coming year should be an exceptionally busy one for Canadian manufacturers."

It is certain that the onus of such statements would not be accepted by such an authority as Hon. Robert Rogers unless material evidence were at hand. The reflection is one which should provide much encouragement for the constructional interests. If the foreign business materializes, a great impetus will be provided Canadian enterprise and in many cases immediate and rapid expansion of manufacturing facilities will take place.

In many respects Canada stands unique as a country able to develop the sinews of war for Great Britain and her allies, and it is to be hoped that our manufacturers will rise to the occasion and prosecute their opportunity with enterprise and vigor. Upon the manner in which they do rise to the occasion depends solely the extent of the trade which will remain to them after the termination of hostilities.

This opportunity of over-seas business is a final argument in favor of a policy of "meeting the present with an eye to the future." This can be effected not by wholesale reductions in staffs and the curtailment of legitimate business expenditure, but by putting forth every effort to maintain the stability of normal times in preparation for the activity which the Hon. Robert Rogers foresees.

In face of Canada's prospects, to relinquish one's hold upon business because of a temporary depression is nothing but business suicide. This is a period of testing, and there is every reason to believe that Canada will emerge from it with the proved capacities of stability and business foresight. With all the horrors of war it is not unlikely that the present conflict will prove to be that "tide in Canada's affairs which, taken at the flood, leads on to fortune."

An order has been received from the British War Office for 200,000 shells. The contract will be divided among various Canadian firms and will keep 1,500 Canadian steel-workers busy. The present contract will not be completed for eight months. The inspection to which the shells are subjected in England is very strict. It is necessary that the finished product pass tests conducted by the officials of the War Office.

The steel shell is made in Canada and filled with leaden bullets. It is loaded with powder at the arsenals in England after the shells have been received and tested. It is stated that this contract and other orders in prospect will open up a new industry in Canada.

Lord Kitchener's Business Sentiments

NOT long since we advanced the editorial plea of "Business as Usual" and observed that "the principles for which it stands are playing a part in the affairs of the Empire second only in importance to the operations in the actual theatre of conflict." There are many who would characterize such sentiment as the natural outcome of a business disposition, but we are assured of the moral support of no less an authority than the head of the British War Office, Lord Kitchener, who writes to Messrs. Siemens Brothers & Company, Limited, expressing his appreciation of the efforts made by the firm's employees and of the quality of the work turned out, at the same time emphasizing his desire that everything shall be done to assist the military authorities by pushing on all orders as rapidly as possible. Lord Kitchener concludes:—

> "I should like all engaged by your company to know that it is fully recognized that **in carrying out the great work of supplying munitions of war they are doing their duty for their King and Country equally with those who have joined the Army for active service in the field.**"

The phrase "munitions of war" is capable of wide interpretation and it may be said to apply to practically every phase of activity which may be classified as constructional. The business of supplying a nation with food, wearing apparel, places to live in—and work, must proceed vigorously whether a country be at war or not. A country devastated by poverty, short rations, ill-housing and lack of employment would soon be unable to develop the sinews of warfare. This principle is recognized in the old country and it is reflected in the statements of a man of such unflinching devotion to the interests of the army as Lord Kitchener.

"The Time of New Openings," says an English Writer in the Westminster Gazette

NOTHING is so difficult as living up to a sentiment, especially when the sentiment has been made for you by somebody else. There are displayed in thousands of shops in London and in hundreds of factories nicely printed notices, "Business as usual," and, with some dazzling exceptions, the proprietors of those notices wonder with lugubrious countenances why business is not as usual. Business is not going to be as usual if in a time of stress and strain men believe that the machinery can be kept running with no more exertion than when the load to be carried is light. No owner of a motor car expects that he can take a hill with the petrol throttled down. He opens his valves, and the engine responds to the fresh impulse. The same thing is true of business life. If speed is to be kept to the normal there must be more energy, more explosive force, more of the will to put one's back into things when the steep and rough road has to be climbed.

"Business as usual" was a good enough motto for the early days of the war, but it is a wretched enough sentiment for a people of enterprise when new opportunities are opening out in every direction. The call at such a time is not for the man who thanks Heaven that his affairs are not so bad as they might be, but for him who says "This is the occasion for which I have longed. I will go out and conquer."

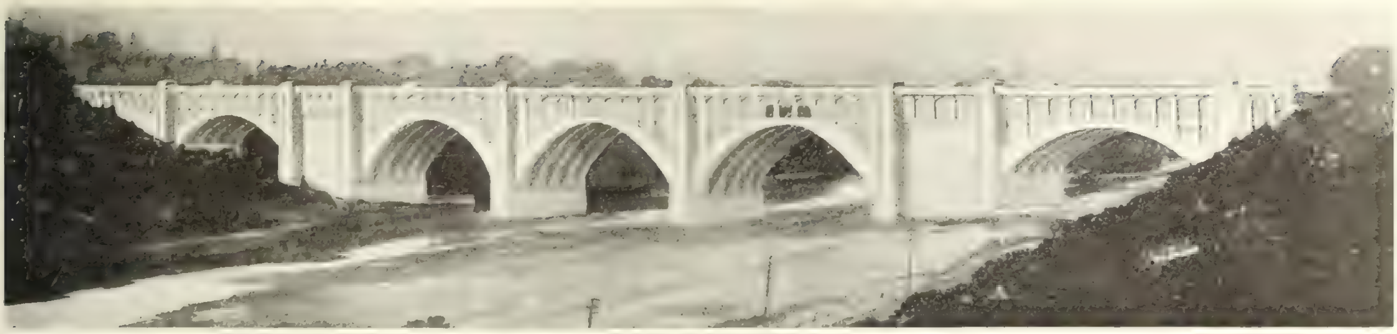
Ever since Germany began to feel its strength in the industrial world the feebler folk have prayed for something to deliver them from this new competitor. "Make him mark his goods," said one school, "and then people will not buy from him." And when the goods were marked people still bought. "Only give us a tariff and then we shall be safe," chimed in another school. In a day, by one single stroke, more has been achieved than the highest tariff wall could have made possible. The formidable competitor has gone; his goods can no longer find their way into the markets of the world; marked or unmarked, charged with a tariff or admitted free, they have ceased to be. And not only in the British market, but in the markets of the world. Wherever a German-made article was supplied, there is room for a British-made article, and if the Britisher does not fill the gap somebody else will. The manufacturer, the wholesaler, or the dealer who anchors himself to the motto "Business as usual" in that situation is not a business man but a vegetable.

Germany's Great Export Trade

Last year Germany sent to this country over forty millions in value of goods, a large proportion of which were partially or wholly manufactured. All these goods have to be replaced somehow; they are wanted by our population of forty millions. There are scarcely any of these articles which cannot be made here, given the capital and the enterprise. They can be made better than they were made by the Germans. But it won't be sufficient to make the goods. They must be marketed, which means that people must know the things they want are being made and where they can be obtained. There is new business to be done, but the customers who are waiting have to be told what people are anxious to have new business and are not content with the purely negative attitude of going on as usual.

Let the plain man take it as a plain fact that "Business as usual" is not going to provide him with a fortune or even enable him to finish the year with his usual substantial balance. He is going to have heavier expenses, higher taxation, greater initial costs. His goods, in an outworn phrase, are going to cost him more, and if he has been buying from the Continent he is not going to get the goods at all. He has to seek new sources of supply and stimulate home manufacturers to strike out along new lines or increase their output to meet new demands. That forty millions of trade in the home market is worth picking up, and somebody will be compelled to pick it up, but it won't be done with the motto "Business as usual," but with the finer idea that new opportunities call for new methods. And when the forty millions have been absorbed the world is a veritable Tom Tiddler's ground in which the gold will be seized by those who have the sight to see that the gold is there.

Let there be no mistake! The buyer is not coming to the man who has over his door the sign "Business as Usual." The seeker after goods is looking for the announcement, "I Want to do New Business." He is seeking, that is to say, the manufacturer or dealer who recognizes possibilities and lets the world know he is ready to fill the new demands arising on all sides. He



Reinforced Concrete Design for Don Section of Bloor Street Viaduct, Toronto

THE above illustration is a perspective of the design prepared by Messrs. James, Loudon & Hertzberg, Engineers, Toronto, for a reinforced concrete bridge on the Don Section of the Bloor Street Viaduct, Toronto. The scheme, which consists of two sections, the Rosedale and the Don, is estimated to involve an expenditure of approximately $2,500,000. The project has been before the ratepayers of Toronto for the last three years, it having been submitted in the form of a by-law in 1911, when the proposal was defeated, and again the following year with a similar result. Finally it met with public approval on the third occasion, in January 1914. The Don Valley section extends from Castle Frank Road to Danforth, its length being about 1,500 feet and its width over all, 86 ft. The longest arch spans are 200 ft. The Board of Control invited tenders on steel and reinforced concrete construction, the design for the former appearing in the Contract Record of July 15, 1914. The lowest tender received on the reinforced concrete type was based on the design of Messrs. James, Loudon & Hertzberg, the amount of the tender of Messrs. Jones & Girouard, Ottawa, being $849,055. The lowest of the steel tenders was submitted by Messrs. Quinlan & Robertson, at $[illegible]. The design providing for steel construction was prepared by the Commissioner of Works, Mr. R. C. Harris. For some time there has ben a lively controversy as to the merits of the respective types of construction, and the result of the examination of the designs by a special committee is awaited with keen interest.

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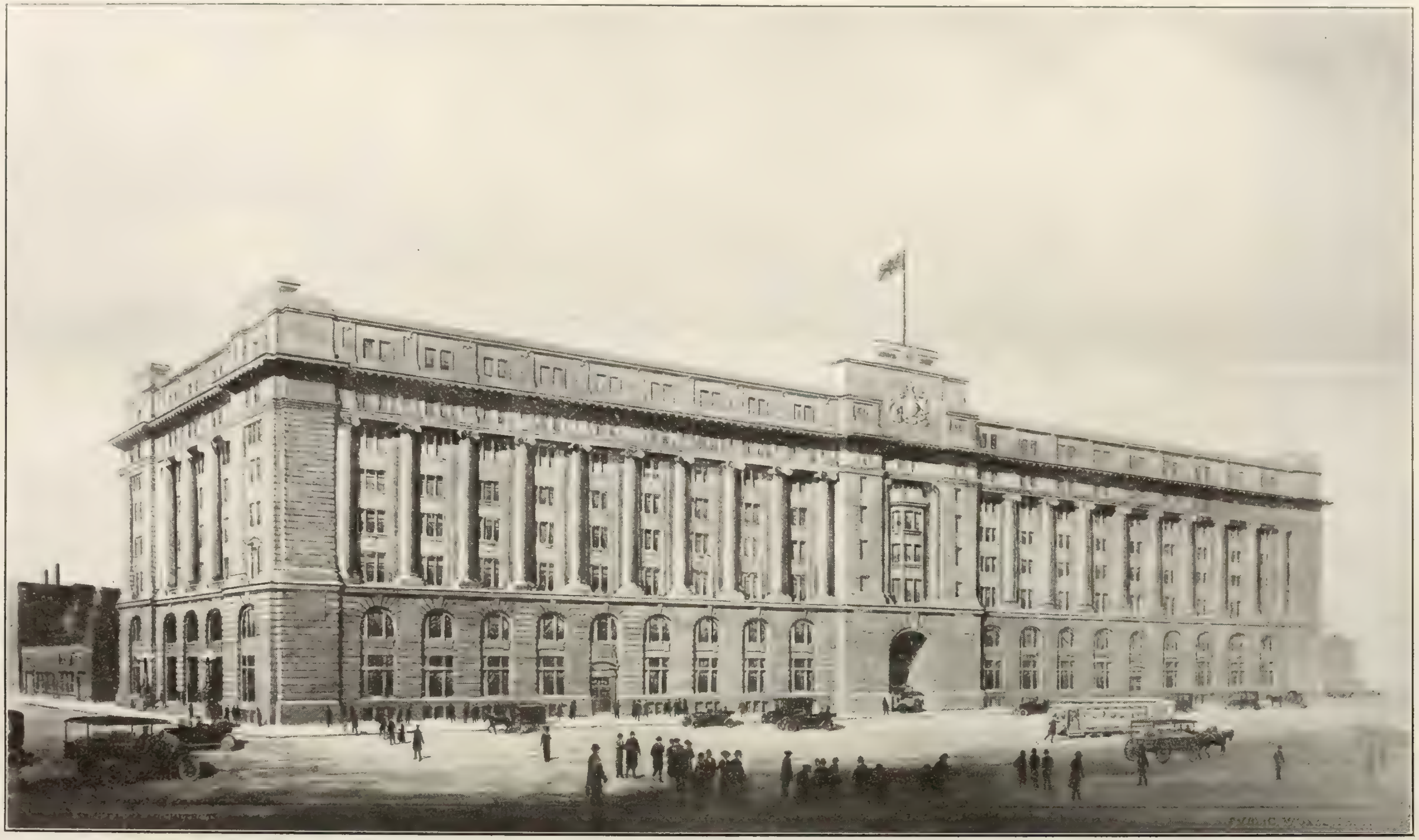
wants to know where his wants can be supplied. He is after the man who advertises. Nothing has been more foolish in the upheaval of settled courses than the widespread decision to cease advertising, and to be content, as a consequence, with dwindling trade. The purpose of advertising is to create customers who will inquire for goods. Without the customers, manufacture and the whole machinery of business is just so much wasted material and effort. With the customer in waiting, there follows the orderly movement of industry and commerce, with profits for all concerned. In exciting days those who want goods want to know also where they can be obtained without the time-testing difficulty of long inquiry and searching. The ready means to inform them is by advertising. No other means can bring about the same results at anything like the same cost.

In orderly days some businesses can subsist without advertising. They go on their settled way doing a regular trade with a fixed number of people on their books. But there are times when new business must be done, when fresh customers must be sought, when the easy-chair attitude is no longer possible. Never was there a period in which wants were changing so rapidly, when there was so insistent a call for daring and enterprise. When the wreck of this war comes to be cleared up, the businesses which will emerge stronger than ever they were will be those which have had faith in themselves, which have not feared in the crisis, but have seized with avidity the chances of the hour and have let the world know that they were doing so.

Concerning the Shape of Modern Theatre Interiors

IN commenting upon the shape of theatres or rather of their auditoria, a writer in a recent issue of the London Times calls attention to the fact that when James Burbage built the first public playhouse he made it round, thus following the principle adopted in the Greek and Roman theatre, the Roman amphitheatre, the bull-rings and bear-rings. The writer makes the point that the Elizabethan theatre had its stage out in the arena, with the audience on three sides of it, and the "Restoration" stage had its "apron" projecting so far out into the auditorium that the people in the side boxes must have seen a great deal of the action from behind.

The modern theatre, it is pointed out, has entirely altered the relative position of stage and audience. The stage is no longer among the audience but a framed picture in front of them, and the writer therefore suggests that the proper shape for a modern theatre auditorium is rectangular, and the retention of side galleries a solecism. Theoretically the principle of the writer is sound, but he forgets that galleries on the side walls enable a larger audience to be grouped within a theatre of a given size, thus with any given audience bringing a larger proportion nearer to the stage, and as theatres are commercial ventures—often, we might say, speculations—making for economy in cost of erection. It may be remembered that in many large concert halls of rectangular form side galleries are used as well as those at the end.



Montreal Examining Warehouse- Architect's perspective of finished building.

Methods Employed on Pneumatic Foundation Work at Montreal

The Foundation Company's Contract in Connection with the Montreal Examining Warehouse and Customs House

PNEUMATIC foundations involving 132 caissons from ground level to rock at 68 or 70 ft. below the ground level are of sufficient importance to merit passing notice. A contract of this size has been completed recently in Montreal, P.Q., for the Dominion Government.

The increasing importance of Montreal as a port of entry influenced the Dominion Government to increase the efficiency for handling the business passing through the Customs Examining Warehouse, and plans were drawn up for a building on the Government property on McGill Street between Place Youville and Youville Street.

The contract as let covered about one-half of the proposed building. At this time pneumatic foundations were not specified. The cellar over the south one-half of the lot was excavated to a general level of about 15 ft. below the surrounding street level, and from the cellar level the sub-contract was later let, covering the pneumatic foundations. This first half was commonly known as the First Part, and about four months later another contract was sublet covering the north half of the lot, which was called the Second Part or the extension. As the work was continuous it is not distorting facts to call the two parts one piece of work involving 132 caissons, 69 on the first part and 63 on the second part.

Diamond drill borings were made to develop the subsoil conditions before the final type of foundation piers were decided upon, such borings being considered absolutely necessary for the intelligent study of the foundation problem, as it enabled the contractors to adapt at the start methods best suited to the existing conditions.

The average curb level on McGill Street was about El. + 28 referred to mean water level in the harbor as zero. At about El. + 5 water was encountered in sufficient quantity to necessitate the use of air in excavating for the foundations. The proposed building was of monumental design and the loads were consequently high. The allowance made for loading on the rock was 16 tons per square foot, this factor determining the size of the larger caissons. On the interior piers, where the loads were lighter, the minimum size caissons was used, the areas of same being determined by the smallest size which could be constructed practically by the pneumatic method.

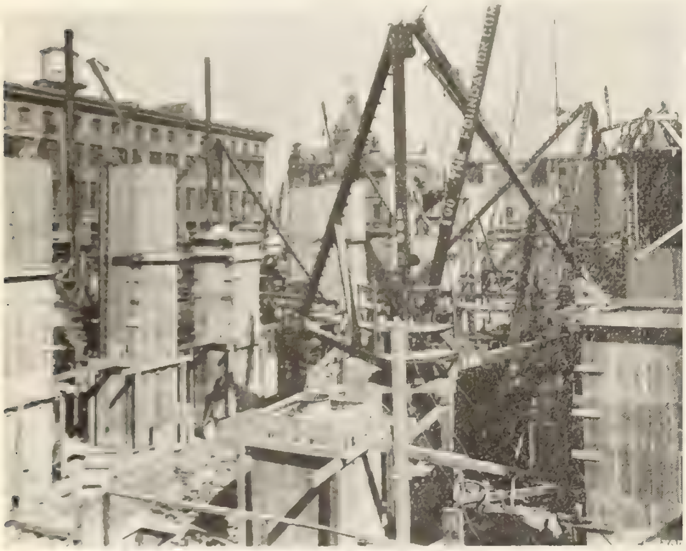
Caisson lock with auxiliary derrick.

Typical built-up caisson with lock set.

Three types of caissons were sunk; the first type comprised caissons with timber working chambers, the second type had concrete working chambers, and the third was adopted to utilize nine dredging caissons, previously started, that were to be converted into pneumatic caissons.

The general procedure in the case of the wooden caissons differed from that of the concrete caissons only in that the concrete working chambers were built in place whereas the wooden working chambers were built in the yard and swung into place by derricks. It is customary to excavate at the site of the pier for a depth of about 5 or 6 ft., and in this pit the working chamber forms were set, shafting and piping attached, and concrete poured in until the caisson was built up as high as the derricks could reach. The concrete was then allowed to stand and the operation of sinking was started by excavating within the working chamber and taking the material out through the shafting by means of caisson buckets hoisted by derricks. When the cutting edge reached about El. — 3, where water necessitated either the putting on of air or more extensive pumping, the sinking was stopped and the caisson again built up to its final height. Compressed air locks were then placed on the shaft, air turned on, and the excavation in the working chamber again started and continued until the caisson had settled to within about ten feet from rock, which brought the top of the built-up concrete to the finished level. The remaining distance to rock was sunk without sheathing or bracing of any kind except the air pressure. When bottom was reached all loose material was removed until good bed rock was secured, then the concreting operations started, which consisted of pouring concrete into the working chamber until it was full, and then filling up the shaft. It will be seen that, by this method, a solid concrete column was obtained from rock to the top of the pier without intervening layers of timber.

Prior to the decision to use the pneumatic method nine caissons had been constructed and dredged to approximately El. — 3 and the operation covering the sinking of these caissons differed from that described above in that it was necessary to convert them into pneumatic caissons and to straighten them, as they were considerably out of plumb. The operation of handling these caissons was first to pump them out, build in a deck, place the shafting, pour a concrete plug, and then concrete around the shafting. After the concrete had stood, more concrete was placed above the working chamber and sinking operations started.


Caissons built up ready for sinking.

The derrick lay-out was planned to give the minimum number of set-ups. The derricks were cribbed up to approximately ground level, which enabled them to place the air locks on the caissons when they were built to their full height on the second lift. The yard for building the caissons was located on McGill Street, as it interfered less at this point with other operations.

Temporary plant was located as closely as possible to the centre of the lot as a whole. Should the Government go ahead with the second part of the building, all available space on the lot was needed for other operations. The concrete mixer had to be placed so as to serve all the derricks, and a point at the centre of the lot was considered the most economical and efficient. The mixer on the first half was located on the cellar level and the material was brought in on the street level. On the second half the mixer was about 6 ft. from the average street level, and the material was delivered to the mixer by an automatic dumping bucket which was loaded at the ground level.

The boiler plant consisted of two 350 h.p. vertical boilers and two 100 h.p. locomotive type boilers. These supplied steam for the compressors, concrete mixer, several hoist engines, as well as a number of steam injectors for unwatering the caissons that were not under compressed air.

The compressor plant consisted of three low pressure machines, the combined capacity of which was about 4,000 cubic feet per minute, and one high compressor machine for the operation of rock drills and boring machines, etc. A 40 kw. dynamo supplied direct current for lighting purposes. A hospital lock was installed for the treatment of any caisson disease that might occur on the job.

The piping system consisted of a 6-in. air main with 4-in. branches running off to serve the caissons, and from these branches, the air was connected direct by two independent lines to the working chambers as well as the usual piping to the locks.

The hoist engines used were of the double drum type, cylinders 7-in. x 10-in. with swing engines having 6 x 8 cylinders. Seven-ton capacity derricks were employed, the fittings for which were specially designed by the contractors. Auxiliary derricks were attached to the air locks, and were operated by 6-in. x 8-in. single drum hoist engines. The mixer was of 30 cubic feet capacity with boiler and engine attached. Lot pumping when necessary was handled by Cameron pumps.

The contract for the pneumatic work on the first section was begun in May, 1913, and the 69 caissons involved were sunk to rock and completed by November, 1913. The contract for the second section was begun in November, 1913, and the 63 caissons on this part were sunk to rock and finished by March, 1914. Some of the quantities involved were approximately 22,250 yards of caisson excavation, 16,000 cu. yds. of concrete, 1,500,000 F.B.M. timber, 24,000 lbs. cement, 1100 boiler h.p., 13 hoisting engines, and 11 air locks.

The work was done under the direction of the Chief Architect's office of the Department of Public Works. Mr. LaPierre represented the Department for the first part and Mr. LaCroix for the second part. The Foundation Company, Limited, were the contractors on all the pneumatic work. Messrs. P. Lyall & Sons Construction Company, Limited, were the general contractors.

The floor panels of the Ford Motor Company's assembling plant at Portland, Ore., are said to be about the largest ever used in a floor of the mushroom type. Plans for the building were filed with the building inspector's office about a month ago and show a 3-storey building, 75 x 300 ft., of reinforced concrete built on the Acme flat-slab system. The slabs are to be 27 by 28 in., 11 in. thick, with some special slabs 20 and 22 ins. thick.

Checking Lists for Estimators on Building Work

By L. A. Waterbury[†]

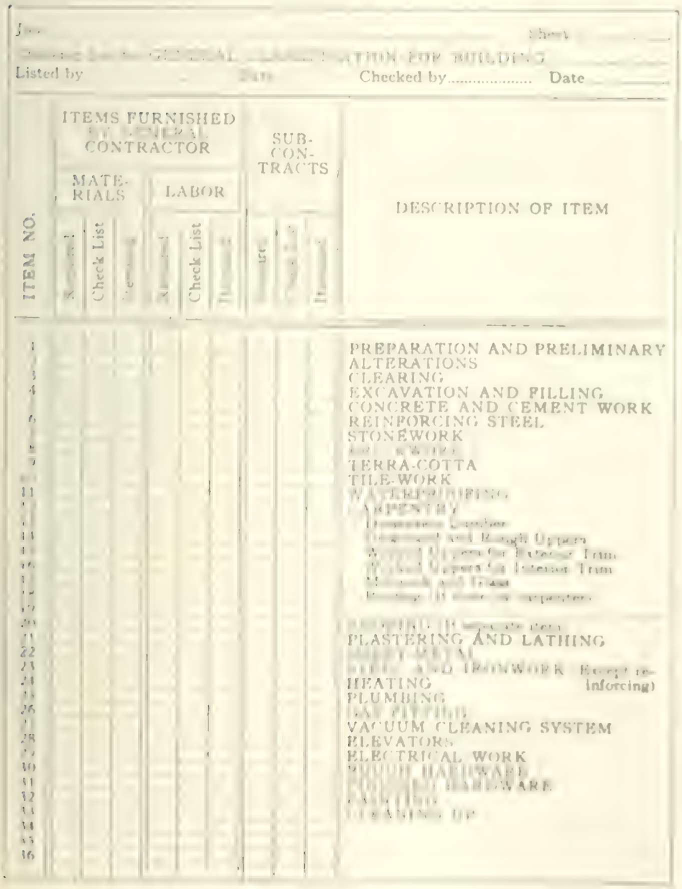
THE preparation of detailed estimates and bills of material for the use of contractors requires considerable care to avoid the omission of items. For work of this character the writer has made use of checking lists which should prove of interest to others. Mimeographed forms are used, made upon 16-lb. bond paper, 8½ x 11 ins., so that the preparation of checking lists for a particular job is done by checking the required items which are listed upon the forms and by adding any unusual items which do not happen to be included upon the mimeographed list.

Before beginning to itemize the quantities to be billed the checking lists are made out for the entire job. For a new job much of this can be done while studying the plans and specifications, noting in particular those items called for in the specifications which might easily be overlooked in taking off quantities from the plans.

The form shown in Fig. 1 is for use in checking the general subdivision of items for building estimates. It will be noted that this form is arranged to indicate whether any particular item is to be furnished by the general contractor or whether it forms a sub-contract. The list also shows whether materials or labor, or both, are required. In the column headed "Required," under each subdivision, a check mark is placed opposite each item for which there is anything to be billed. In the column headed "Check List" there is placed the number of the sheet on which will be found a detailed check list for the item. For some items no detailed check list will be needed. In the column headed "Itemized" there is placed the number of the sheet on which the billing of the item begins. When the billing for an item of the general list has been completed, a second check mark is placed in the "Required" column, for which purpose it is desirable to use a different color than that used for the first check. The writer uses black for the first checking and red for the final checking.

In billing the items, all of the materials may be itemized first, then the labor, and to the summary of these may be added the sub-contracts. In this case the final checking proceeds down each vertical column in succession. When it is desired to bill the items so as to show the complete cost of materials and labor for the separate items, the checking proceeds across the horizontal lines in succession. Upon completion of the estimate the checking list serves as an index for reference to the itemized bill.

A detailed checking list for concrete is shown in Fig. 2. Similar detailed checking lists for lumber and millwork are shown in Figs. 3 to 7 inclusive. It will be noted that the detailed lists differ from the general

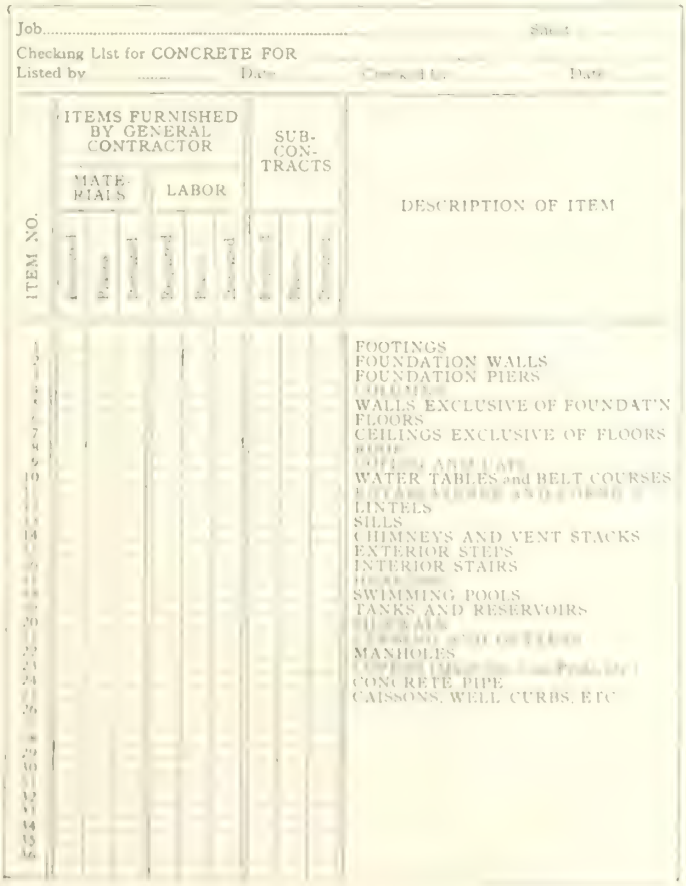


Job ... Sheet ...
Checking List for GENERAL CLASSIFICATION FOR BUILDING
Listed by ... Date ... Checked by.................. Date ...

ITEM NO.
ITEMS FURNISHED BY GENERAL CONTRACTOR
MATERIALS: Required, Check List, Itemized
LABOR: Required, Check List, Itemized
SUB-CONTRACTS: Required, [illegible], Itemized
DESCRIPTION OF ITEM

1 PREPARATION AND PRELIMINARY
2 ALTERATIONS
3 CLEARING
4 EXCAVATION AND FILLING
5 CONCRETE AND CEMENT WORK
6 REINFORCING STEEL
7 STONEWORK
8 BRICKWORK
9 TERRA-COTTA
10 TILE-WORK
11 WATERPROOFING
12 CARPENTRY
13 Dimension Lumber
14 Common and Rough Uppers
15 Worked Uppers for Exterior Trim
16 Worked Uppers for Interior Trim
17 Millwork and Glass
18 Roofing (If done by carpenters)
19
20 ROOFING (If separate con.)
21 PLASTERING AND LATHING
22 SHEET METAL
23 STEEL AND IRONWORK (Except reinforcing)
24 HEATING
25 PLUMBING
26 GAS FITTING
27 VACUUM CLEANING SYSTEM
28 ELEVATORS
29 ELECTRICAL WORK
30 ROUGH HARDWARE
31 FINISH HARDWARE
32 PAINTING
33 CLEANING UP
34
35
36

Fig. 1.—Checking list for general classification of items



Job.. Sheet ...
Checking List for CONCRETE FOR ...
Listed by ... Date ... Checked by ... Date ...

ITEM NO.
ITEMS FURNISHED BY GENERAL CONTRACTOR
MATERIALS
LABOR
SUB-CONTRACTS
DESCRIPTION OF ITEM

1 FOOTINGS
2 FOUNDATION WALLS
3 FOUNDATION PIERS
4 COLUMNS
5 WALLS EXCLUSIVE OF FOUNDAT'N
6 FLOORS
7 CEILINGS EXCLUSIVE OF FLOORS
8 ROOFS
9 COPING AND CAPS
10 WATER TABLES and BELT COURSES
11 [illegible]
12 LINTELS
13 SILLS
14 CHIMNEYS AND VENT STACKS
15 EXTERIOR STEPS
16 INTERIOR STAIRS
17 [illegible]
18 SWIMMING POOLS
19 TANKS AND RESERVOIRS
20 SIDEWALKS
21 [illegible]
22 MANHOLES
23 [illegible]
24 CONCRETE PIPE
25 CAISSONS, WELL CURBS, ETC
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Fig. 2.—Checking list for concrete work

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*Engineering and Contracting, Chicago.

[†] Professor of Civil Engineering in the University of Arizona.

list in that "Places" is used as a column heading in the detailed lists where "Check List" is used in the general list. In the column headed "Places" there is inserted the number of places on the job where the corresponding item occurs. Certain items occur on more than one list, since for different cases they will need to be billed in different ways, depending usually upon whether the materials required can be purchased from stock or whether they are special. In case all of the interior trim is obtained from the mill the lists for interior trim and for millwork virtually form a single list. If some item, such as "Ceiling," is not included in the items to be obtained from the mill, whereas the balance of the items on the list come from the mill, no confusion would ordinarily occur, since the items to come from the mill would be checked in the column headed "Sub-contracts," and the item "Ceiling" would be checked under "Items Furnished by General Contractor."

Job.. Sheet..................
Checking List for DIMENSION LUMBER FOR ....
Listed by .... Date .... Checked by.................. Date..................

ITEM NO.	ITEMS FURNISHED BY GENERAL CONTRACTOR						SUB-CONTRACTS			DESCRIPTION OF ITEM
	MATERIALS			LABOR						
	Required	Places	Itemized	Required	Places	Itemized	Required	Places	Itemized	
1										MUD SILLS
2										UNDERPINNING
3										SILLS
4										GIRDERS
5										FLOOR JOISTS
6										CEILING JOISTS
7										BRIDGING (Over 1 in.)
8										STUDDING
9										BRACING FOR STUDDING
10										RIBBON GIRTS (Over 1 in.)
11										PLATES
12										POSTS AND COLUMNS (Unmilled)
13										PILLAR FRAMING
14										BOLSTERS AND CORBELS
15										ROOF TRUSSES
16										PURLINS
17										RAFTERS
18										COLLAR BEAMS (Over 1 in.)
19										RIDGE BOARDS (Over 1 in.)
20										ROOF BRACING (Over 1 in.)
21										STAIR STRINGERS
22										PARAPET FRAMING
23										RAILINGS (Unmilled)
24										TOWER FRAMING
25										CORNICE FRAMING
26										SKYLIGHT FRAMING
27										WOOD LINTELS
28										ROUGH DOOR BUCKS
29										CONCRETE FORMS (Over 1 in.)
30										STAGGING
31										
32										
33										
34										
35										
36										

Fig. 3.—Checking list for dimension lumber.

For reinforcement, a list having the same items as the list for concrete is suitable. For other items of the general classification, such as brickwork, stonework, etc., detailed checking lists are not difficult to prepare. The lists for lumber are given in detail because the writer has had considerable difficulty in developing lists which were satisfactory.

The following comparative statistics are illuminating as to the progress by the province of Saskatchewan during the last decade. The population has increased from 140,500 to 675,000 and the railway mileage from 1,053 to 5,356. In 1903 the total area surveyed was 64,152 square miles and in 1913, 121,680 square miles. In the former year there were 240 grain elevators with a capacity of 7,205,000 bushels and in the latter year there were 1,424 grain elevators with a capacity of 44,294,900 bushels. Ten years ago the cities, towns, villages and municipalities combined totalled only 20, while at the end of 1913 there were 7 cities, 71 towns, 281 villages and 295 municipalities.

Limitations of Water Filters*

By George W. Fuller, Consulting Engineer, New York

IT has often been taken as a matter of course that the addition of an ordinary water filter either of the slow sand type or the mechanical type would be sufficient to bring the water to a condition of perfect purity in all its properties and make it absolutely satisfactory and sufficient for all drinking purposes. There seems no doubt that a water filter can only affect so much and no more in the way of bacterial purification. Having in mind limits such as these, it will be necessary to determine how much of a burden the condition of the raw water will impose on the filter.

B. Coli Determination

A water may have a very large number of bacteria and still be absolutely harmless. The determination of B. coli has come to be recognized to be the most satisfactory of the possible methods of determining the pollution of a water. B. coli of itself is not, of course, any direct indicator of disease-bearing bacillus. It is only a very indirect evidence of the possibility of recent fecal pollution.

An International Joint Commission, composed of appointees of the United States and of Canada, has been investigating the pollution of the international boundary waters, with the idea of determining to what extent pollution must be limited in order not to endanger the health of the communities on the two sides of these boundary waters. The best that can be done with the data at hand is to consider all these data, properly weigh them, and on the basis of a rather general judgment come to some conclusion on what is a proper limit of B. coli in water to be applied to the filters. Such a conclusion can by no means be considered rather an average than a rigid limit for any particular case. This standard specifies that water applied to filters should show by the presumptive test not more than 500 B. coli per 100 cu. cm. of water as a yearly average, meaning by this that B. coli should not be found more than 50 per cent. of the time in 0.10-cu. cm. samples. For averages for shorter selected times, monthly, weekly, or daily, the allowable B. coli content may be considerably higher. It is believed that for this purpose the averages based on a year's readings are more useful than averages for a shorter time with a correspondingly different standard of allowable B. coli.

The bacterial efficiency of a filter is not an invariable quantity. Roughly speaking, 98 to 99 per cent. may be placed as a fair average under ordinary conditions. With these conditions in mind, it seems reasonably safe to say that a water having in its raw form a coli content not exceeding 500 per each 100 cu. cm., based on yearly averages, will show in the water supplied to the consumers something not more than five to ten B. coli per 100 cu. cm. Such water is believed to be a fairly safe water, when properly sterilized, for drinking purposes and for all other domestic uses.

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*From a paper abstracted by the Engineering Record.

Job .... Sheet ....
Checking List for UNWORKED AND ROUGH UPPERS FOR ....
Listed by .... Date .... Checked by .... Date ....

ITEM NO.	ITEMS FURNISHED BY GENERAL CONTRACTOR						SUB-CONTRACTS			DESCRIPTION OF ITEM
	MATERIALS			LABOR						
	Required	Places	Itemized	Required	Places	Itemized	Required	Places	Itemized	
1										RIBBON GIRTS (1 in. and under)
2										PLATES "
3										BRIDGING "
4										BRACING FOR STUDDING "
5										ROOF BRACING " "
6										COLLAR BEAMS "
7										ROUGH FLOORING
8										SHEATHING
9										UNW'RK'D LUMBER, PILLARS (1 in.)
10										" " STAIRS "
11										" " PARAPETS "
12										" " RAILINGS "
13										" " LOUVRES "
14										" " TOWERS "
15										" " SKYLIGH'S "
16										" " EXTER. TRIM
17										" " INTER. TRIM
18										FURRING STRIPS
19										GROUNDS
20										RIDGE BOARDS (1 in.)
21										LUMBER FOR FORMS (1 in.)
22										LUMBER FOR STAGGING (1 in.)
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										

Fig. 4.—Checking list for unworked and rough uppers.

Job .... Sheet ....
Checking List for WORKED UPPERS FOR INTERIOR TRIM FOR ....
Listed by .... Date .... Checked by .... Date ....

ITEM NO.	ITEMS FURNISHED BY GENERAL CONTRACTOR						SUB-CONTRACTS			DESCRIPTION OF ITEM
	MATERIALS			LABOR						
	Required	Places	Itemized	Required	Places	Itemized	Required	Places	Itemized	
1										FINISHED FLOORING
2										CASING (Windows, Doors)
3										PULLEY STYLE (If not with frames)
4										DOOR JAMBS " "
5										STOPS (Windows, Doors)
6										WINDOW STOOL
7										WINDOW APRON
8										BASE MOULD (Pieces)
9										PICTURE MOULD (If stock pattern)
10										PLATE RAIL " "
11										FALSE BEAMS " "
12										CHAIR RAIL
13										WAINSCOT
14										SHELVING
15										HOOK STRIPS
16										CEILING
17										THRESHOLDS
18										STAIRS (If not in Millwork)
19										DRAIN-BOARD " "
20										BENCHES " "
21										COUNTERS " "
22										INTERIOR COLUMNS(Except Millw'k)
23										LATH (If not included in plaster)
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										

Fig. 6.—Checking list for worked uppers for interior trim.

Job .... Sheet ....
Checking List for WORKED UPPERS FOR EXTERIOR TRIM FOR ....
Listed by .... Date .... Checked by .... Date ....

ITEM NO.	ITEMS FURNISHED BY GENERAL CONTRACTOR						SUB-CONTRACTS			DESCRIPTION OF ITEM
	MATERIALS			LABOR						
	Required	Places	Itemized	Required	Places	Itemized	Required	Places	Itemized	
1										LOUVRES
2										RAFTER ENDS
3										FINISHED SHEATHING
4										SIDING
5										RAILINGS (If not in Millwork)
6										CORNICE
7										FRIEZE
8										ARCHITRAVE
9										TENIA
10										SOFFITS
11										LUMBER FOR COLUMNS & PILLARS
12										FINISHED FLOORING (Exterior)
13										STAIRS AND STEPS "
14										BELT BANDS
15										WATER TABLE (If not in Millwork)
16										DRIP CAP
17										CORNER TRIM
18										GRILLE AND PATTERN TRIM
19										LATTICE WORK
20										PARAPETS
21										CEILING (Exterior)
22										SHINGLES
23										BATTENS
24										PICKETS
25										BENCHES (Ifnot in Millwork)
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										

Fig. 5.—Checking list for worked uppers for exterior trim.

Job .... Sheet ....
Checking List for MILLWORK AND GLASS FOR ....
Listed by .... Date .... Checked by .... Date ....

ITEM NO.	ITEMS FURNISHED BY GENERAL CONTRACTOR						SUB-CONTRACTS			DESCRIPTION OF ITEM
	MATERIALS			LABOR						
	Required	Places	Itemized	Required	Places	Itemized	Required	Places	Itemized	
1										WINDOW FRAMES, DOUBLE HUNG
2										" " CASEMENTS
3										" " FIXED SASH
4										DOOR FRAMES, DBL. WITH TR.
5										" " " NO "
6										" " SIN. WITH "
7										" " " NO "
8										VENT FRAMES (If milled)
9										SCUTTLE FRAMES " "
10										LOUVRES " "
11										STORE FRONTS
12										SASH, DOUBLE HUNG
13										" CASEMENTS
14										" FIXED
15										SKYLIGHTS
16										GLASS (If not with other items)
17										DOORS, EXTERIOR
18										" INTERIOR
19										" SCUTTLE OR BATTEN
20										STAIRS (If milled)
21										RAILINGS "
22										PLATE RAIL "
23										DRAIN BOARD (See Interior Trim)
24										BENCHES " " "
25										COUNTERS " " "
26										COLUMNS (If milled)
27										CORNICE " "
28										FRIEZE & ARCHITRAVE (If milled)
29										SOFFITS (If milled)
30										CABINETS AND CASES
31										
32										
33										
34										
35										
36										

Fig. 7.—Checking list for millwork and glass.

Checking Lists for Estimators on Building Work.

The Relation of Geology to Railway-Tunnel Location[*]

By Edwin C. Eckel[†]

MOST railway tunnels are so located as to pass through a barrier range at some relatively low point. The railroad was headed for a gap or pass through the range in order to secure as low a crossing point as possible, and the tunnel represents an effort to make a little further reduction in the elevation of the crossing point.

The fact that a gap or pass exists at a certain point in a mountain range is not a matter of accident; there is always a cause for its location at that particular point. In most cases, it is possible to say, after study of the case in the field, that the pass owes its location to some peculiarity in the structure or composition of the rocks at that point.

Other things being equal, depressions along a mountain ridge are likely to occur where soft or soluble rocks reach the ground surface. If the rocks of the range are so placed that a depression of this kind extends at right angles to the range, it may in time be extended entirely across it, giving rise to a gap. Fig. 1 illustrates a hypothetical case of this kind, where a series of limestones, inclosed by harder rocks, have been worn down below the general crest level. On a small scale, gaps owing their origin to this cause are fairly common.

A second cause is erosion of the crest of an arch or anticline. Fracturing is common at this point during the folding of the rocks, and the weakness thus induced may at a later date give rise to deep erosion along the weakened zone, and the ultimate formation of a gap across a ridge. This is illustrated in Fig. 2, showing a condition which could be readily duplicated in many parts of the South.

Faulting on a large scale also causes zones of weakness and easy erosion, and gaps may arise from this cause, as shown in Fig. 3. In many cases, where a gap or pass is located along a fault zone, we have to deal not only with such weakness as may have been the direct result of faulting, but with the fact that the fault may have brought into contact at the surface two sets of rocks differing widely in hardness and resistance to weathering. In such cases, the gap is due to the indirect effects of the fault, rather than to the direct structural weakness.

Another very common type of gap, particularly in certain portions of the southern Appalachian region, is that caused by the arrangement of the rock folds and, consequently, of the mountain masses. This can be seen best along the line of the Chesapeake & Ohio R. R. in the section near the Virginia-West Virginia state boundary, where examples are encountered at frequent intervals. The rocks in this area are arranged in steep folds, and in most cases the mountain ridges represent actual arches or anticlines in the underlying rocks. Cross folding at intervals causes an echelon arrangement of the ridges, and the roads and streams follow through around the ends of these ridges at relatively low crossings. Fig. 4 is an attempt to suggest the main features of this sort of topography.

If the entire ridge which has to be tunneled were composed of one kind of rock, if the structure of this rock were everywhere uniform, and if no faults or other dislocations existed, it would, of course, make little difference where the tunnel was driven. Such homogeneous rock-masses are frequently found in text-books, but they are really quite rare in the outside world. Usually the engineer will find, on examining the ridge which faces him, that it is made up of several distinct kinds of rock, that these kinds of rock differ in hardness and other physical characters, and that different portions of the ridge probably show differences in the formation of the rocks. All of these facts will have some bearing on the cost of driving and operating the proposed tunnel; and it will be well to get some idea in advance as to how the ground conditions can be made to fit in best with the other requirements of the line. If a relatively slight shift in alignment is going to give cheaper work, either in constructing or operating, without bringing in any serious new difficulties, it will certainly pay to make the change.

Shale.—Cutting through shale usually means fast driving and cheap extraction, for the material breaks so readily that the quantity extracted per man or per pound of powder is commonly far higher than in any other rock. But when this is said, all the advantages have been mentioned. The final completion of the tunnel may be dangerous and expensive, and the cost of maintenance may turn out very high unless it is completely lined at once. In some cases, timbering must follow up close behind the heading, in order to prevent falling fragments and to retain the roof line. Shale is ordinarily full of closely set joint planes. On a freshly exposed surface, these may not show markedly, but exposure to the air induces "slaking," the joints open, and the shale breaks into fragments. Further than this, water is apt to be carried in quantity along some of the more strongly marked joint planes.

Slate.—The material reported as slate in the progress of the work may be a real roofing slate, but it is more apt to be a dense shale, breaking out in tabular masses instead of irregular fragments. In either case the driving is easy if the bedding or cleavage are in such an attitude that advantage can be taken of them; but work across the grain is difficult and expensive. There is less frequency of falls of roof during working than in dealing with other shales, but on the other hand the size of the falling masses makes the matter more serious when it does happen. If the bedding is vertical or nearly so, lining will usually be unnecessary; if the bedding is horizontal, falls may be expected to occur at intervals. The importance of the tunnel will then have to determine whether all of these should be guarded against from the outset.

Sandstone.—Sandstones vary widely in physical properties, from thin-bedded fragile materials that can be readily broken with a pick up to dense vitreous quartzites that will wreck all the tool steel on the job.

Quartzites are sandstones in which the original quartz grains have been cemented together by infiltrating silica. They are dense, resistant to physical and chemical changes, difficult and expensive to excavate. Fortunately, they occur principally in regions of extreme metamorphism, and are therefore common only in certain mountainous portions near the eastern and western coasts, and in the Lake Superior region. In steeply folded regions, the quartzites may be barely jointed. In this case their excavation is easier, but at the same time the joint planes give access to water.

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[*] Extracts from a forthcoming book on "Geology as Applied to Engineering Work."

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Throughout most of the central and eastern United States, the sandstones found are reasonably dense, varying from stones like the Berea stone up to the much denser and tougher bluestones or flagstones. They give fairly cheap driving, especially where the bedding is in a favorable attitude, and make excellent roofs and sides. Taken as a group, sandstones of this intermediate type probably furnish the cheapest tunnel work, when construction and maintenance both are considered.

West of the 95th meridian, most of the sandstones encountered in the plains region and along the immediate Pacific coast are fragile, thin-bedded materials, readily excavated and yet commonly strong enough to hold position after the cut is driven.

Gneiss.—The banded metamorphic rocks, such as gneiss, schist, etc., will differ greatly in difficulty of treatment, the variations being due not so much to differences in mineral or chemical composition, as to the attitude of their banding or apparent bedding planes, the thickness of the plates or beds into which they are separated, and the presence and relative importance of joints. A gneiss lying horizontally or nearly so, and without frequent joints or thin banding, is perhaps more expensive to handle than any granite. On the other hand, a gneiss or schist whose banding is at right angles to the course of the heading will commonly break almost as readily as flagstone. In any case, except where joints are very numerous and open, the roof and sides will be secure. Water softening with lime and then allowing the turbidity to settle out, along with the precipitated carbonates. Turbid water has never been successfully disinfected with hypochlorite, because the bacteria imbedded in the suspended matter are not destroyed.

(7) The sterilizing action persists indefinitely. In a paper on water disinfection by chemical methods, Samuel Rideal states the advantages of using chemicals that persist in their disinfecting action, in the following words: "may enter either along the apparent bedding planes, or along joint planes; but ordinarily the quantity will not be serious."

Granite.—For convenience, all of the massive igneous rocks may be included here under this heading, and as a matter of fact most of them will be true granites or closely allied. Under ordinary circumstances, rock of this type will afford very expensive excavation, but good sound roofs and sides, and practically no water trouble — the point is worth bearing in mind. Granites do not have any bedding planes, and ordinarily show little banding or foliation. But even the densest and most massive looking granite will break with considerably greater ease in one direction than in another. This direction can only be found by experiment in each case, but it worth going to this trouble early in the work in order to secure extra efficiency in drilling and blasting operations later.

Limestone.—Limestones differ from all the roofs which have heretofore been mentioned, in a very striking and important way. The other rocks, from shales to granites, weather chiefly or entirely from an exposed surface, so that if the rocks exposed on the ground above the tunnel alignment seem fresh, there need be little fear of striking decayed rock in the headings. But limestone acts differently. It is very soluble, and water penetrating along joint planes or through the mass of the rock itself will gradually work out large channels or cavities to a great depth. These may remain open, or be partly filled up by "clay seams."

Limestone is an easily handled rock, and a sound thick-bedded limestone will make for cheap drivng and good roofs and sides. But in driving a limestone tunnel there is always the chance that the next blast will play havoc with all calculations by opening up a clay seam, a cave, or a water channel. The difficulty is not so much the increased expense, as the fact that the interruptions are unexpected and so hard to guard against in advance.

Owing to differences in composition, texture, bedding, position and climate, limestones show wide differences in solubility and cavity formation. Other things being equal, caves and large water channels are most likely to occur in a limestone lying horizontally or nearly so. On the other hand, steeply dipping limestones will frequently show clay seams extending from the surface downward for 50 ft. or more.

These facts may be used for guidance. If the ridge consists partly or entirely of flat-lying limestone beds, the presence of known caves in the same general region, or the existence of exceptionally large springs breaking out along the flanks of the ridge, should serve as a warning. On the other hand, if the beds dip at angles of 35 deg. or more, attention should be paid to their appearance along a line across the ridge over the tunnel alignment. The occurrence of bands of red or deep yellow clay, apparently interbedded with sound limestone, will in that case suggest that these seams may go deep enough to be encountered in the tunnel work.

Rock Folds.—It is but rarely that a tunnel passes through rock beds lying flat or nearly so, because low points in ridges do not usually occur in areas of horiontal and undisturbed rocks. Normally, the rocks will be dipping at fairly high angles, which may indeed approach the vertical. Normally, also, the strike or trend of the rocks will be more nearly at right angles to the course of the tunnel than parallel to it. These conditions arise from the general modes of origin of mountain ranges and passes.

Whatever the angle of dip, the rock will break most readily from a bedding plane, slips and falls will

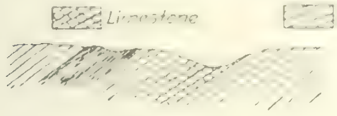

Fig. 1—Gap caused by erosion of softer rock.

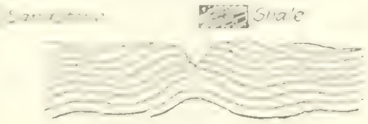

Fig. 2—Gap caused by erosion of weak crest of arch or anticlinal fold.

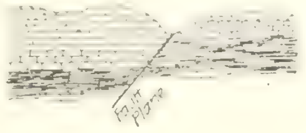

Fig. 3—Gap caused by erosion along weakened fault plane.

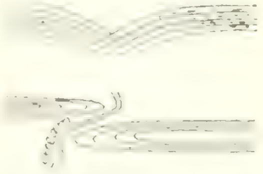

Fig. 4—Gap due to overlapping folds.

commonly originate on such planes, and the chief water flows may be expected along them. The presence of numerous or very open joints may, however, operate to modify these conclusions. So far as work is concerned, if the rock beds dip parallel to the side of the ridge, the blasting will be least effective, and the water troubles greatest; if the rocks on the contrary dip into the mountain, the excavation work will be cheapest, though perhaps more dangerous; while the chance of heavy water flows will usually be slight. The chance of falls or slips will be least with horizontal or vertical rocks, and greatest with rocks dipping between 35 and 70 deg. or thereabout. Of course, allowances must be made, in reaching conclusions, for variations in the thickness, of the individual beds, and for differences in the tightness or openness of the bedding planes.

Contact Planes.—All of the features which characterize ordinary bedding planes are emphasized on those planes where two different kinds of rock are brought into contact. The chance of slipping and the possibility of water troubles are both present at such points. This is true even where the contact is an ordinary conformable one, both rocks having the same dip; it becomes still more important where the contact plane is marked by faulting.

Fault Planes.—Since the existence of a fault implies that there has been movement along its plane, the rocks on one side having been raised or lowered relatively to those on the other side, it can be seen that the fault plane and the zone of rock in its immediate vicinity are likely to offer engineering difficulties. When fracturing or brecciation of the rocks has accompanied the faulting, the effects may extend over a considerable zone, and their technical importance may be heavily increased. But even where there is no serious rock fracturing, the fault plane itself offers opportunities for easy rock movement, which may vary in intensity from simple roof falls to serious slips. And, in addition, the plane of the fault is likely to offer an easy passage for surface and subsurface waters.

For these reasons, a faulted zone is not likely to give cheap and safe tunnel driving, or cheap maintenance; and if it is possible to detect the presence of fault in advance, and locate its position on the ground, it will pay to go to considerable trouble to avoid its neighborhood, by shifts in either alignment or level.

A Discussion of Traffic Factors*

By J. Eastwood, A. M. Inst. C. E.

In order to consider the relative merits of various forms of road construction, and to compare the results obtained in one road with the results obtained in another, it is necessary to have some standard of comparison of traffic. There are many difficulties in the way of fixing upon a simple, universal standard, and there is a danger of arriving at a false and misleading simplicity by ignoring many vital points. It will, however, be a real step forward if there can be agreed upon a standard which will hold good even within a limited area. Such a standard would be, as pointed out by the author in the correspondence on Mr. J. Walker Smith's paper,* of great value to the engineer in considering the question of improving the roads within the area, by affording an index to the durability, and hence the relative cost of various kinds of road construction under given conditions of traffic.

At one time it was considered sufficient in taking a traffic census to count the vehicles passing in a given time, but it has long been recognized that such a method of enumeration is useless for comparing a mixed mass of traffic passing along a given road with a mixed and possibly very dissimilar mass of traffic passing along another road. The late Mr. G. F. Deacon proposed to reduce traffic to a standard of tons per yard width of roadway per annum, and this is a system which has been largely followed, the Form of Summary of Statistics of Traffic issued by the Road Board being based on this method. While this is a great advance on the previous method, it does not take sufficient note of the character of the traffic and of the road surface.

A little consideration will lead to the conclusion that many other factors besides weight have an influence in determining the destructive effect of traffic on road surfaces. To take an instance which occurred within the author's experience: On a certain road which was paved with granite on concrete foundation, and had a gradient of 1 in 22 to 1 in 13, there was considerable motor wagon traffic to a neighbouring factory, a motor wagon with steel tyres passing backwards and forwards frequently, usually with a full load on the down journey. Under these conditions the life of the granite was from two to three years only, the setts being crushed to pieces. The steel tyres were then removed and rubber ones substituted, with the result that the life of the paving was more than doubled, though the traffic in tons per yard width per annum was practically the same throughout the period. Again, compare the destructive effect of a motor car with steel-studded tyres travelling at a fast speed on a macadamized road with that of a heavy motor wagon with rubber tyres passing slowly along a paved road. Mr. Walker Smith in the paper previously referred to says:—

"It will no doubt be readily granted that upon macadam surfaces a 10-ton traction engine will do more damage than ten units of 1 ton each; but here again the extent of the relative damage will not be constant, as the extra damaging effect per ton of the heavier vehicles will decrease as the strength of the road increases, and, apart from questions of weight, all rubber-tyred vehicles—particularly heavy fast-running motor vehicles—will have a more detrimental effect upon the surface of a water-bound road than upon the surface of a bituminous-bound road. It would therefore appear to be necessary, in order to standardize traffic effects, to lay down coefficients of potential damaging effect."

To this it may be added, as a necessary corollary, that the vehicles mentioned will also have a more detrimental effect upon macadamized roads generally than upon paved surfaces. In correspondence on the paper, Mr. Walker Smith again reiterated that he did not agree that coefficients of potential damaging effect

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[illegible] in The Surveyor, (London).

should be based on the intensity of weight on the road.

It is the aim of this paper to discuss the conditions influencing the value of coefficients of potential damaging effect, or, as some American engineers call them, "traffic factors," a term which the author has adopted as being not quite so cumbrous as the other. The author has already enumerated some of these conditions in the correspondence on Mr. Walker Smith's paper, in which he also quoted factors suggested by Major Crosby, chief engineer, Maryland Geological and Economic Survey, and the New York State authorities. It will be seen, therefore, that the author is not advancing any novel suggestions, but rather elaborating previous ones, particularly the combining of leading features of both the method of traffic factors and that of the standard of traffic per unit width, by dividing the total traffic number by the width of the road in order to allow for difference in width, as suggested in the above correspondence.

It will be evident that the ideal table of traffic factors will contain factors for each class of traffic on every kind of road surface, and under all variations of conditions which are seen to affect the value of such factors. Such an ideal table is naturally unattainable, and if attainable would be too complicated to be of value. The tables of the American authorities, above cited, refer only to ordinary macadamized roads, while the tables in Mr. Walker Smith's paper refer to such roads, and also to macadamized roads with bituminous binding. In the present paper factors are proposed for certain classes of traffic for both macadamized and paved roads. These values are such as the author's present experience lead him to consider suitable, but owing to the lack of sufficient data they are only suggested as tentative figures to be modified in the future as experience may indicate to be necessary, as it is apparent that a table of traffic factors must be an empirical one, and must be continually checked and readjusted as fresh data are forthcoming.

The following considerations will all bear on the question of the wearing effect of traffic on road surfaces:—

Road.—Surface formation, foundation, gradient.
Class of Traffic.—Weight, intensity of weight, description of tyres, speed, method of shoeing in the case of horses.
Weather Conditions.
Width of Road.

The method of arriving at suitable traffic factors for various classes of road surfaces is as follows: Typical roads are selected where the effects of foundation and gradient may be neglected, and it is found that, comparing macadamized surfaces in one part of these roads with paved roads of different kinds in other parts of these roads, and subjected, as nearly as can be judged, to the same traffic, the lives, say, of granite macadamized roads, York stone paving and granite paving are in the ratio of 1:2½:6. If then factors for the different kinds of traffic passing over these roads can be agreed upon, say, for macadamized roads, it becomes an easy matter to deduce from these factors for other classes of road surfaces, provided a reliable traffic census is available. In the supposed case it will not answer the purpose merely to alter all the factors in the same proportions. The results of the census must be taken, and the various factors adjusted by trial until the total traffic numbers for the various classes of surface are inversely in the agreed ratio of the lives of these surfaces. A comparison of the various values given in table 6 wil make this clearer.

The question of road surfaces generally has been referred to in the preliminary remarks. A few other points affecting traffic factors may now be briefly referred to.

Foundation

Closely allied to the question of surface formation is that of foundation, and the destructive effects of heavy traffic—especially heavy traffic per unit width of tyre—or of fast motor traffic with studded tyres, on macadamized roads without proper foundation are well known. There is another aspect of foundation which is perhaps not so well recognized, and that is the effect of a rigid foundation, such as concrete, in holding up the surface to the pounding action of fast-moving steel-tyred motors or similar heavy traffic. The road surface is then literally between the hammer and the anvil, and if the force of the impact exceeds the crushing resistance of the material the result is disastrous—as, for example, in the case of the granite road referred to earlier, where the setts were crushed to pieces in from two to three years. Similar cases occur with gritstone paving, even when not on concrete, provided the bed upon which it is laid is fairly solid.

The effect of a bad foundation cannot be allowed for in a standard table of traffic factors as the questions of degree and nature of defects then arise. The object in drawing attention to it here is to emphasize the fact that in gathering data for constructing such a table care must be taken that the observations are confined to roads where the foundations are such that the results will not be vitiated by them.

Gradient

The damaging effect of horse traffic, in particular, is considerably increased by heavy gradients, the digging and pounding action of the horses' feet in drawings loads up the hill being very destructive of the road surface. On macadamized roads it loosens the surface and digs out the stones, while in wet weather the surface, being soft, is pounded to a pulp and the stones rounded in such a way that disintegration in dry weather is greatly facilitated. With paved surfaces the horses can only get a good foothold in the joints of the setts, and consequently wherever their shoes first strike the surface they slide downwards until they reach a joint, and the faces of the setts are soon so rounded that the horses can only obtain a foothold with difficulty.

In a particular instance York stone paving on a gradient of 1 in 9 had in twelve months worn down 1½ ins. at the middle of the sett to 3 ins. at the joint on the up side of a street in which on the down side the life of the paving was about four years. The up traffic was confined to one line, owing to metal plates having been placed for the wheels of vehicles to run upon, and consequently the whole of the above-mentioned wear was due to the horses' feet. The down traffic also tended to keep mostly in one line, as many of the vehicles had slippers on one wheel, and ground against the kerb with the other to act as a brake.

Generally speaking, in several cases where, owing to tramway lines in the centre of the road, or other causes, the tarffic up and down roads having a gradient of 1 in 9 to 1 in 14 [illegible] has tended to keep each to its own side, the life of paving on the up side has been from one-half to one-third of that on the down side, owing to this rounding of the setts.

In the accompanying tables an arbitrary division has been fixed upon at a gradient of about 1 in 14, and different factors are given for roads steeper and for roads flatter than this. It will be understood that there is no sharply defined difference between what happens on a gradient of 1 in 14 and on a gradient of 1 in 15. The effect due to gradient increases gradually as the gradient increases, and since the line must be drawn somewhere, it was thought fair to draw it at a gradient of 1 in 14, though this is entirely a matter of opinion, and it may be that this arbitrary division should vary with the nature of the road surface.

Class of Traffic

The weight of vehicles, and more especially the intensity of weight, must have consideration in drawing up a table of traffic factors, as, other things being equal, a fast moving vehicle will do more damage than a slow moving one. Some authorities are of opinion that weight multiplied by speed would give a good basis for traffic factors for self-propelled vehicles, but this seems too severe upon light fast moving vehicles, though this, again, will depend somewhat on road surface, tyres, and so on. Since a vehicle is not always loaded up to its utmost capacity, nor always driven at its utmost speed, it is possible to attach too much importance to considerations of weight and speed. The influence of possible speed on the traffic factor will vary with the locality. On heavily trafficked urban or suburban roads a vehicle will not as often approach its speed limit as on a rural road, so that what seems to the town surveyor to be a suitable factor may appear unsuitable for a rural district.

It will scarcely be necessary to enlarge on the question of tyres, as it is plain that different tyres—rubber, rubber studded with steel, steel, and steel with transverse bars, as in traction engines—have widely varying effects on road surfaces.

In the case of horse traffic the damage to the road surface depends a good deal upon the method of shoeing. In many towns in the North having steep gradients, the horses, especially heavy horses, are shod in such a way as to give them a better foothold, and, incidentally, to damage the road surface much more than those which are flat shod. In summer they are shod with toe-bits at the front of the shoe and caulkers at the back. For a heavy carthorse the toe-bit is an oblong piece about ⅝-in. square and 4 ins. in length, fixed across the toe, and the caulkers are about 1¼ ins. square, and project about ¾-in. from the face of the shoe. In winter the horses are shod with plug shoes, having four holes into which steel plugs can be driven. These plugs project ½-in. to ¾-in., and newly sharpened plugs are inserted on the appearance of frost. Should the frost be of short duration, followed by a quick thaw, the effect of these plugs, both on macadamized and paved surfaces, is very severe.

Weather

Where the atmosphere is generally humid, and there is a considerable proportion of wet days, the damaging effect will be greater on roads generally, and particularly on water-bound roads, than in the case of a drier atmosphere and with fewer wet days. It is not so much a question of comparing rainfall as the number of wet days and the general humidity.

Width of Road

The author proposes to allow for variation in width by dividing the total traffic number by the width of the road. If, however, the road is so narrow that there is only room for two lines of traffic, the effect of the traffic is greater than would be indicated by the ratio total traffic divided by width, owing to the surface becoming rutted. Cases which have come under the author's notice include one in which granite paving, owing to this cause, had a life of two to three years only as compared with ten years with the same traffic under ordinary conditions, and another in which gritstone paving had a life of four years, as against eight years under ordinary conditions further along the same road. This, however, is one of the local influences for which special allowance must be made, and which is outside the scope of a general table.

It will be seen that the question of traffic factors is a complicated one, and one which can only be simplified by careful observations, continued over a long period. Unfortunately, this research is costly, and it would be difficult to persuade local authorities having charge of roads that it would be of sufficient value to repay the cost.

Tile Work Decoration

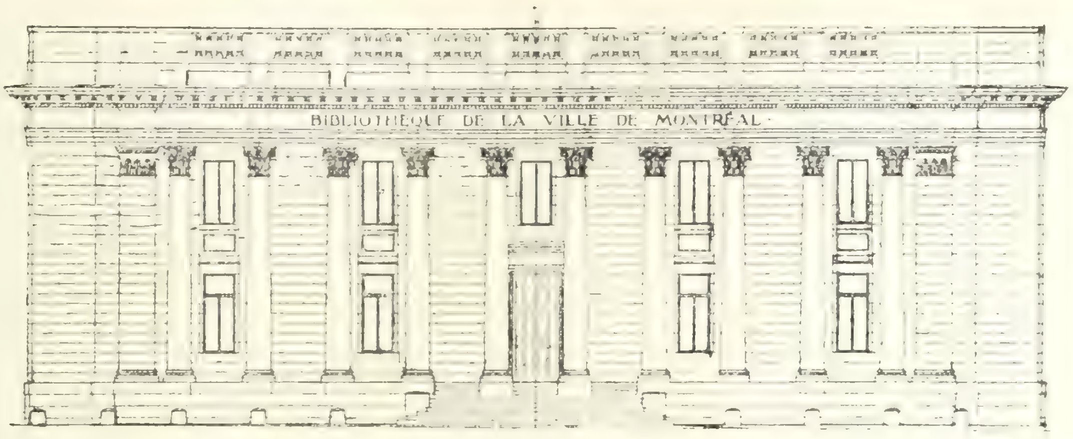
In the course of a very interesting paper on "The Architecture of Portugal," read before the London Architectural Association by W. H. Ward, associate member of the Royal Institute of British Architects, and illustrated by a large number of lantern slides from photographs taken and plans made by the author, the following comments were presented dealing with tile work decoration.

Perhaps the most obvious and enduring effect of Moorish tradition lies in the use of tiled linings. The manufacture of colored glazed tiles in the East is almost as old as history. It was introduced into Spain by the Arabs, perhaps as early as the eighth century, but no existing examples can be proved to be earlier than the thirteenth. Their beauty of color, and the cool expanses of floor and wall surface which they provide, so grateful in the torrid heats of summer, earned them a wide popularity in the Peninsula which they have ever since retained.

In the earliest examples the tiles are self-colored—either bluish-green, brown, dark violet, or milky-white, and of various shapes, and they are laid in geometrical patterns. Later on, a process was invented of producing a pattern on single tiles, by cutting a design in incised lines on a wooden stamp, which was reproduced in raised lines on the soft clay; color being then run into the intervening spaces.

The designs were usually of the star type, but grotesque animals and flower and foliage motifs were sometimes introduced; a little later embossed tiles, especially in vine patterns, came into use. At Cintra are several rooms decorated with high dadoes of some of these kinds of tiles, some of them being finished with cusped and crocketed crestings. The tiles used are mostly self-colored, or nearly so; but the old cathedral at Coimbra exhibits fine examples of patterned tiles of the fourteenth century clothing the walls, and, till the recent restoration, also the piers, while a bewildering variety of rickly-colered devices produces a tapestry-like effect.

At the Renaissance the star paterns were supplemented by scroll and other flowing ornamentation, and the range of color became more varied, being painted on the tiles without bounding ridges. The patterns are sometimes continuous, covering the whole walls, as in the seventeenth- century sacristy of Sta. Cruz, or enclosed in architectural borders, as at Sao Amaro at Alcantra. About the same time lustre tiles



Proposed Civic Library, Sherbrooke Street East, Montreal. Architect, Mr. E. Payette.

—first pale gold and, later, red gold—also came into use.

But after the expulsion of the Moors in 1609 the art of the tile-maker gradually declined, the colors lost in brillance, and their range became restricted to blue designs on white grounds, with purple and yellow as occasional variants. The blue-and-white technique seems to have arisen simultaneously at Delft and in Portugal, and in each case seems to be the outcome of a desire to imitate Chinese porcelain, then becoming known in Europe. Many of these tiles had a single flower vase or figure subject on each.

The practice, however, of making large figure subjects in ornamental borders, with a portion only of the total design painted on each individual tile, came in during the sixteenth century and continued till the early nineteenth. An example occurs in the nave of Sta. Cruz at Coimbra. Tile linings were applied, not only to rooms, but to cloisters, tanks, steps, garden-seats, and even roofs, but their use for entire house-fronts, now common in Portuguese towns, seems to be no earlier than the nineteenth century; and that is, it came in when both the color and the design of the tiles had sunk to insignificance.

New Civic Library for Montreal

THE Montreal City Council have approved the plans of Mr. E. Payette for a civic library to be erected on Sherbrooke Street East, between Montcalm and Beaudry Streets. The frontage of the building on Sherbrooke Street will be 115 feet, and the depth, to both Montcalm and Beaudry streets, 210 feet. The building will be of stone, with a granite base, and will have an eight-foot portico, embellished by ten polished monolith marble columns. The height of the facade on this side is 50 feet 6 inches from the sidewalk. The main distributing hall, approached by a short flight of steps and through an artistic entrance, will be 28 feet by 56 feet and 33 feet high. On the left of this hall is the general reading room, 31 feet by 110 feet, and on the right, the newspaper and magazine room, librarians' office, cataloging and stock rooms.

Wide staircases from either side of the vestibule lead to a gallery on the second floor, from which is reached the art, patent and map rooms, exhibition room, which will be devoted to works of statuary and paintings by local artists; and the Canadian room, where several valuable collections will be placed.

The ground floor, approached from Montcalm Street, distinct from the other entrances, will be set apart for the use of children. The reading room will be 78 feet by 38 feet. On this floor will also be found the bindery, stationery, warehousing and cloak rooms. In the basement, provision has been made for the janitor's apartments, ventilating plant, heating apparatus and cellarage.

The Council have awarded the contract for constructing the foundation of the building to the Foundation Company, Limited, Montreal.

Concrete as a material for gate structures in American irrigation canals is beginning to displace wood, its durability overcoming the disadvantage of higher cost. Bulletin No. 115 of the United States Department of Agriculture purposes to submit to engineers such designs for gate structures for controlling the flow of water in ditches or canal systems as are adapted to different localities. Small and medium-size structures, for the most part, are described in the new bulletin. It does not attempt to exhaust the subject, but merely gives examples of structures which have satisfactorily served the purpose for which they were erected. As regards material, the opinion of the investigator seems to be that a structure of combined wood and concrete, using the latter for inaccessible parts and wood for easily replaced parts, is the best practice.

According to a design now being introduced by an Italian firm, reinforced concrete sleepers are constructed as girder beams having at each cross-section between the rail seats a resistance uniformly proportionate to the bending stress there. The central reinforcement consists of iron ties, one row at the top and another row at the bottom, interconnected or with two such rows, the inner rows being crossed, and the sleeper having triangular or rectangular openings corresponding to the ties. The rails rest on elastic lugs, free at one end, or on a platform at the upper end of a post of reinforced concrete. To vary the gauge, the bolt holes correspond to a frustum of a pyramid or cone on an oblique prism or cylinder, and bolts are used having a shank shaped to fill the hole wholly or partly. Openings in the sleeper give access to the nuts.

New Police Headquarters, Vancouver

AN outstanding example of recent building construction at Vancouver is the fine new structure at the corner of Gore Avenue and Cordova Street, wherein is accommodated the police headquarters of the terminal city. The work bears numerous evidences of having been carefully planned to the minutest detail with the object of fulfilling the peculiar and exacting requirements of a building of this type, and in the strictly utilitarian sense, as well as from an architectural standpoint, it admirably conforms with the purpose for which it was intended.

The ground space occupied measures 100 x 122 feet and the height is five storeys with full basement. The construction is fireproof, comprising reinforced concrete and steel. The main footings have been carried to hard pan at an average depth of 14 feet below grade, but in the North East corner of the site it was found necessary to excavate from 10 to 12 feet below the depth of the main footings before hard pan was reached. The height of the basement is 10 feet 6 inches and the basement walls measure 13 inches in thickness.

The building has been designed to carry three additional storeys at some time in the future and on this account the construction across the wide spans such as the court rooms and parade rooms, was made especially substantial, a 40-foot 6-inch steel span being provided in the court room, while the length of the parade room span is 40 feet. The foundation work is also unusually heavy and the extra thickness of the columns is noticeable, the basement columns measuring from 22 x 22 inches square to 24 x 24 inches square, decreasing in strength of course in the upper storeys.

All outside walls above the basement consist of an 8-inch thickness of Dennison hollow tile and a 4-inch outer lining of brick. Tapestry brick, Roman size, distinguishes the front elevation on Cordova street, and buff colored pressed brick is employed for the side and rear elevations. The interior walls are tile, with the exception of the partitions enclosing the cell rooms, which are of heavy reinforced concrete construction.

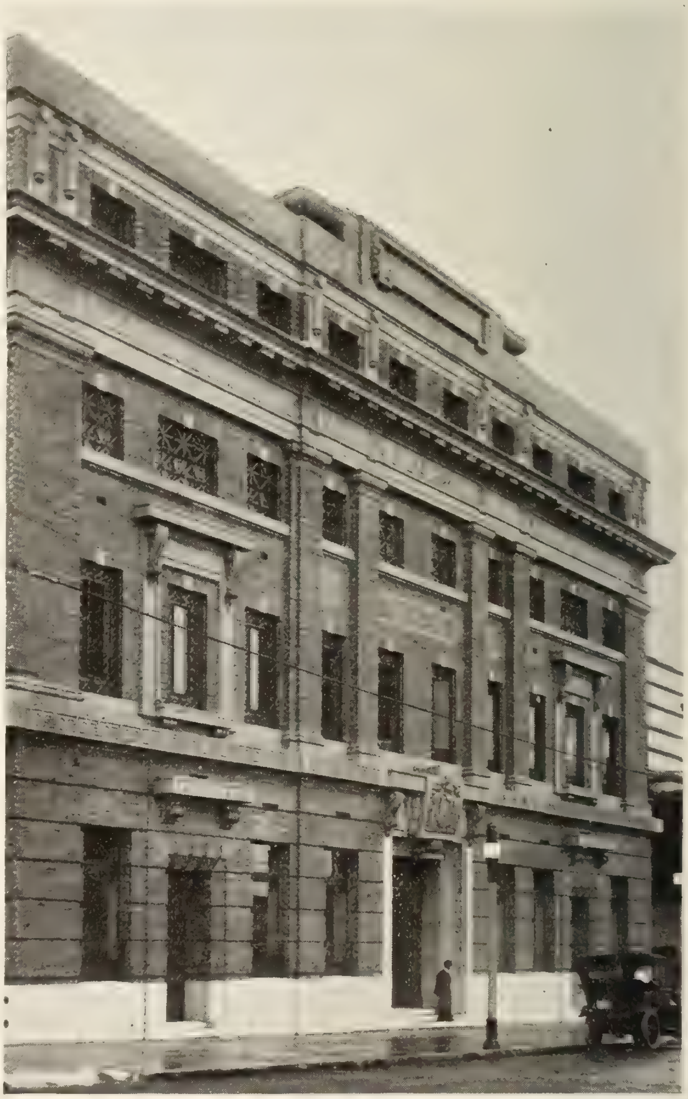
The majority of the floors consist of steel floretyle and concrete but in some parts of the building the floors are of solid reinforced concrete slab. In the former style of construction, floretyle 8 inches thick is used, on top of which is a 2½-inch layer of concrete with a cement finish. The concrete slab floors are 6 inches thick on the average and finished with a coating of cement.

The roof is also of 6-inch concrete slab but with a tar and gravel covering. The surface of the roof to the leaders has been graded with cinders grouted with cement, and tar, felt and gravel laid on top. The waterproofing of the basement, under the foundations as well as on the concrete floor, and up to grade at the sides was treated similarly to the roof.

The building is heated by the vacuum steam system with fuel oil burning plant. The ventilation is on the extradition plan, the pure air entering the building over radiators placed in the various rooms and the fuel air extracted by a large fan placed in the roof where the air is conveyed by means of galvanized iron ducts of No. 24 gauge. The fan is of the Multivane type, capable of delivering 14,000 cubic feet of air per minute, and is operated by an electric motor to which it is belted. The motor is a 10 h.p., 1,120 r.p.m., 220 volt, 60-cycle, 3-phase motor complete with bed plates, switches, etc.

The treatment of the front elevation has been carried out in the classic style of architecture with brick and cream colored terra cotta relief. A granite base extends from grade to the windows of the first floor. The base of the pilasters at the sills of the second-storey windows is formed by a band of terra cotta, two feet thick. This is succeeded by brick treatment to the entableture on the fourth storey floor level, and brick and terra cotta work from there to the roof.

Three entrances are provided on the Cordova street frontage. The main or public entrance leading to the main hall is surmounted by an attractive design of the Vancouver Coat-of-Arms, treated in terra cotta The outside doors are of oak studded with heavy bronze studs. Above the doorways are an ornamental iron grille 1½ feet in height. The decorative effect on the exterior of all entrances is in terra cotta.

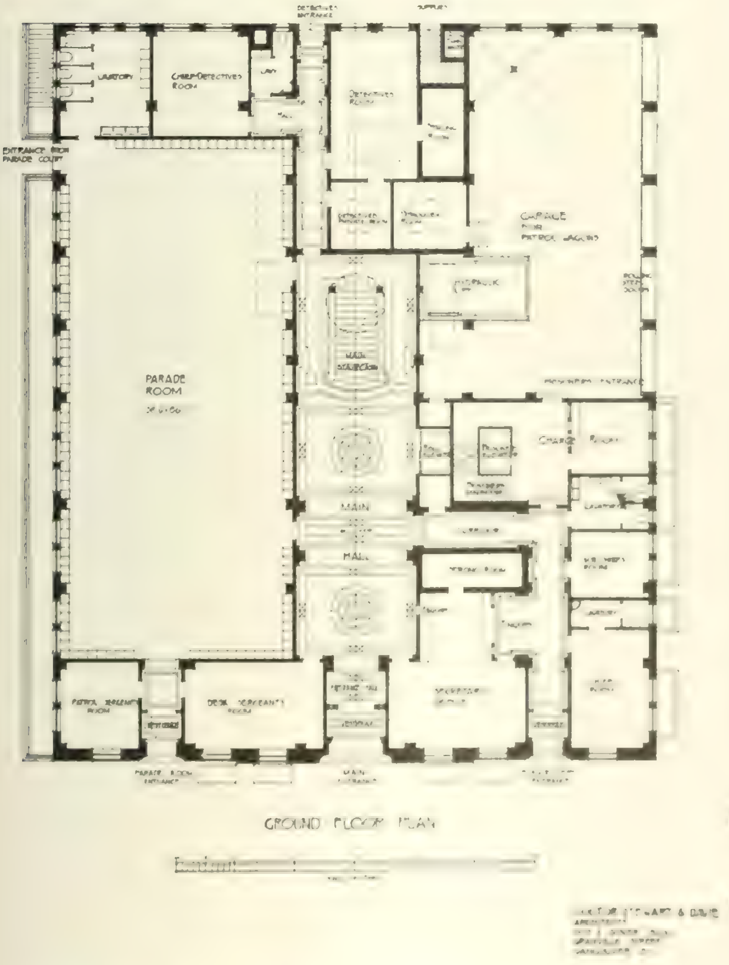


Front elevation, Vancouver's new Police Headquarters.

The windows throughout the building are fitted with steel sash. Those extending along the front elevation on the ground floor are in police departments and have wrought iron grilles, as also have the windows of the court room on the second floor. Bars of strap iron protect the windows of the cell rooms on the third floor.

The interior arrangements are of the most complete description and the decorative effects, especially in the lower floors, are extremely lavish. Laurentian marble wainscotting has been provided in the main hall to a height of 8 feet 6 inches, and in the entrance vestibule this trim extends 10 feet high. Massive pilasters of this material reach from floor to ceiling at each side of the doorways in the entrance hall, a height of about 12 feet. The stretch of wall between the top of the marble panelling and the ceiling is treated in raised plaster panel. The ceiling itself calls for no special comment being carried out with a view to simplicity. The floor of the entrance vestibule is laid with terrazzo tile with inserts of various colored marbles. The main staircase leading from the ground floor to the first floor and decorated with marble has a wrought iron balustrade. Over the staircase is a large steel dome with generous decoration of enriched plaster and ornamental stained glass, from which is suspended a handsome electric drop light. The volume of daylight entering thorugh a five-light stained glass window on the staircase landing and also by way of the dome is of sufficient power to ensure admirable lighting in the vicinity of the hall and staircase during the daytime.

PLAN OF
POLICE COURT BUILDING
VANCOUVER B.C



There are two court rooms on the first floor each measuring about 40 feet x 40 feet. Both rooms are treated with an oak dado 7 feet high which extends around the walls forming a base to the plaster pilasters which are carried to the ceiling beams. The wood work behind the judge's bench is carved oak, and the remaining interior wood finish as well as the furniture is also of oak. The ceiling is carried out in a simple scheme of enriched plaster.

A first rate idea of the general layout on the main floor can be gained from a careful study of the accompanying plan. As will be gathered from the drawing two of the main divisions on this floor are a parade room, measuring 38 feet 6 inches x 86 feet and a large garage where careful provision has been made for the care of the numerous motor vehicles used by the police department. The principal features of the first floor are the two court rooms which have already been described. Adjoining these are judge's and witnesses' rooms, and prisoners' waiting corridor, the latter communicating with cells. The upper hall occupies the centre of this floor and the general offices of the police department as well as apartments for detectives have been placed at the rear. The court rooms occupying the height of two full storeys take up the space at the front of the second floor and the remainder of the space, with the exception of a public hall, has been given over to prisoners' cell rooms of which there are 40 on this floor alone. The cells all face windows having only a corridor about 6 feet between the barred cell door and the barred windows which provide plenty of light and air. The doors of the cells are operated from a lever box in the guard's corridor, the lever equipment being of the latest type and capable of controlling the movements of any number of doors at a given time. Consultation rooms, guard rooms, etc., and lavatories and toilets for prisoners are also provided on the second floor. The third floor contains cells with connecting apartments and male and female hospital wards, the lighting and airing of the latter being particularly effective. There are 67 cells on this floor. They are of the double portable steel type providing accommodation for twice that number of prisoners. On the fourth floor are situated the city health and analyst's departments. Also a kitchen, measuring 40 x 24 feet with usual accessories for preparing meals for prisoners, photographic department, museum, gymnasium, 70 x 31 feet, with dressing room and lavatory accommodation for the use of constables, and tailor shop.

Grouped around the lower hall in the basement are locker rooms, electricians' department where is installed the operating board for a comprehensive and up-to-date police patrol system, and the police telephone exchange, room for linemen, stolen property room with fireproof vault in connection, cell accommodations for 18 prisoners, workshop for repairing motor vans, etc.

In addition to two electrically controlled elevators with which the building has been equipped, there is one hydraulic elevator for raising and lowering motor vans between the garage and the workshop.

Vancouver's new police station was designed by the architectural firm of Doctor, Stewart & Davie, of that city, and C. F. Perry, a local contractor, carried out the general contract.

The building was completed towards the latter part of the summer and represents a total outlay of approximately [illegible]

"Business as Usual" as a motto seems pretty hard to beat, but here is an improved version of it which has been adopted by Messrs. Gent & Company, Limited, wholesale manufacturing electricians of Leicester, England, whose products are well known in Canada:—**"Business as Usual, but More Of It."**

Sewage-Disposal Works in European Cities

By George E. Datesman

THROUGHOUT England, where rivers are comparatively small, sewage disposal plants are undergoing reconstruction, and some form of bacterial treatment in beds is being added to the preliminary treatment. In some cases it has been found to be economical to turn the earlier works into scrap and build entirely new, as at Leeds. The disposal of sludge, except where it is carried to sea, has been generally inadequate. This is now considered by many the most vital problem. In Germany by several processes the problem of sludge disposal has been successfully solved.

As to the present status of the art the following statements may safely be made:

Sewage, even of exceptional concentration, can be effectively treated so as to secure a clear, odorless, sparkling, non-putrescible effluent before discharging into a stream the securing of which is a matter of cost and therefore an economic as well as a constructive problem.

Sludge resulting from sewage treatment can be rendered innocuous, practically inodorous, wholly unobjectionable, after which it may be dealt with in various ways.

Desired results may be secured by certain combinations of treatment at a fraction of the cost of other recognized scientific methods of treatment in satisfactory operations.

In general it is cheaper to treat water, when practical disinfection can be secured, by the admixture of from 0.3 to 0.7 p.p.m. of available chlorine instead of attempting to secure an uncertain comparative result in the treatment of sewage effluent by the admixture of from 2 to 6 parts, with a probability of having to resort to an equal amount of treatment for the water notwithstanding the sewage treatment.

Notable as being the best of their kinds are the following works, listed according to methods used: Hamburg, screening and dilution in the Elbe; Dresden, grit chamber and fine screening with dilution in the Elbe; Vienna, efficient collecting systems with dilution in the Danube; Frankfort-on-Maine, grit chambers, screens, settling tanks, sludge dried in centrifugals, further dried by heat and burned under boilers to produce electric current; Wilmersdorf, primary settling tanks, percolating filters, secondary tanks, sand filtration, sludge in lagoons; Cologne and Dusseldorf, fine screening and tankage, with dilution in the Rhine; Berlin and Paris, farms; London, screens and tanks, with dilution in the Thames; Manchester and Sheffield, screens, tanks and contact beds; Birmingham, detritus tanks, settling tanks and percolating filters, sludge in lagoons; Salford, grit chambers, settling tanks, roughing filter, percolating filters, sludge mixed with chemicals, pressed and dried. Many others will outclass these when new works shall be in operation.

The quality of material and workmanship in sewer construction are superfine, due in a measure to mechanics' wages being one-third of ours.

Percolating filters and their operation may be best studied in England. Scientific experimentation on this system has been more thoroughly carried out in Paris. The investigations upon river dilution have been carried on thoroughly in Germany. Sludge disposal, except where it is carried to sea, has not been solved in England.

The English sanitary world is hopeful that we are on the eve of developing a more intensive, economical and effective means of treatment than the percolating filter.—Engineering Record.

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*Principal Assistant Engineer, Bureau of Surveys, Philadelphia.

Consistency of Concrete

For the foundation and walls of buildings, enough water should be used in the concrete so that it will flow to all parts of the mold with a small amount of puddling and spading. For columns, beams, floor-slabs, and roof-slabs, the mass should have a quaky consistency such as will tend to flatten out of its own weight when piled. The mortar surface of floors should be mixed with sufficient water to make it work easily, but an excess of water should be avoided. Concrete blocks, sills, and lintels should be mixed just as wet as possible with the block machine employed. Blocks and sills made of a mixture wet enough to be quaky when placed in the mold, will be dense and water-tight. Blocks made with dry materials are porous, lack strength, and present a dead appearance. It must always be remembered that the bonding quality of cement in concrete depends upon a hydraulic action between the cement and the water, in which each plays an equally important part. The lack of sufficient water to complete this action is therefore as detrimental as the lack of cement.

Dynamite inserted in lengths of condemned fire hose was used to cut to pieces the steel drill barge "Teredo" which had been sunk at Panama by an accidental explosion. It having been found impracticable to raise it, it was decided to cut it to pieces. The hose with its charge of explosives was placed along the line at which it was desired to direct the force of the blast and, according to the "Canal Record," made a fairly clean cut. The sections sheared off were raised by wrecking barges assisted by a dipper dredge.

The damaged portions of concrete floors which have been chipped or cracked by hard usage may be chipped out with a chisel and mallet to a sufficient depth to reach the bottom of the deepest break. The rough surface is then treated with acid so as to bring out the solid aggregate, or a stiff brush is used to remove all the loose dust. The surface is washed out with a hose, and when all the dust and traces of acid have been removed, the recess is grouted with cement. Before the latter has set granolithic finish is applied and levelled up with the rest of the floor.

At the 25th annual convention of Ontario Association of Architects, held recently in Toronto, the President, Mr. C. H. Acton Bond, declared it to be the duty of architects to promote additional employment by substituting stone for terra cotta wherever possible. In using stone they were patronizing a home industry and the general policy advocated by him would help materially during the war period. The suggestion received the unanimous approval of the meeting. The affairs of the Society were shown to be flourishing. At present the membership is 172, an increase over last year of 32, while the finances of the organization are in better condition than ever before. The Toronto city improvements suggested by the Civic Guild were explained to the meeting by Mr. Edmund Burke and Mr. Frank Wickson.

The Durability of Creosoted Piling

REMARKABLY short life is attributed to untreated Douglas fir piles in San Francisco and southern California ports, about 2½ years being considered by some engineers the longest that should be expected. Other engineers who have had more satisfactory experience with the untreated piles place its probable average life in service, other than in fender lines, at from 4 to 6 years. It is significant that 100 per cent. of all the untreated piles driven since 1906 by one railroad company in four Pacific Coast ports had to be replaced within 7 years. It is, therefore, generally agreed that some form of treatment is necessary if wooden piles are to be used in the more permanent structures; and, after considerable experiment, treatment with creosote has come to be the only method now used extensively on the Pacific Coast.

The question as to whether it is economical to continue treating piles, now that creosote costs 10.04 cents, as against 7¼ cents per gallon in 1912, was recently sent from the manager's office to the engineering department of a large company. The engineer showed in reply that a 1-cent increase in the price per gallon of creosote would increase the cost of the treated piles 1 cent per linear foot, and that, taking the life of untreated piles at 8 years and creosoted piles at 30 years, it would be economical to treat piles until the cost of treatment reached 32 cents per linear foot, which corresponds to a creosote cost of 22 cents per gallon. These figures are based on a cost for untreated Douglas fir piles of 10 cents per foot, as against 30 cents for creosoted piles. Assuming $6 for driving in each case, a 40-foot untreated pile in place would be worth $10 and a treated pile of equal length in place would cost $18.

The life of a treated pile will be determined largely by the condition of its outer surface after it is driven. Mechanical injuries, such as result from hooks, spikes or hammer blows, are to be carefully avoided, but even more serious than these is the checking that may result from treatment or that may develop in driving. In addition to the weakening and the exposure to the teredo due to checking, a new danger was discovered recently in Wilmington harbor. In this case piles which had checked considerably were found to be fairly sound on the surface, but within had been cut into "lacework" by borers much smaller than the teredo. Sections of these piles were submitted to experts to determine whether some hitherto unknown marine borer had attacked them, but careful examination showed the borers to be the common limnoria, which had abandoned its usual method of cutting around the exterior and had gone inside through cracks in the otherwise well-protected surface.

On the other hand, an instance of exceptionally good surface protection is found in the long wharf at Santa Monica. Piles in this structure were treated and driven in 1892 and at present the outer end of the wharf is no longer in use and is being removed by breaking the piles off at the ground line about [illegible] feet below the surface. After 22 years of service most of the piles removed are being sharpened and redriven in the repair of bents beneath an electric railway track, and the [illegible] of the redriving crew reports them less liable to break under the hammer than freshly treated piles.

Total Annual Charge Against Creosoted Pile Piers

Interest charges at 4 per cent.	$0.0400
Annual maintenance	.0500
Replacement fund, 20 years	.0336
Redemption fund, 75 years	.0022
Insurance	.0060
Total annual charges per sq. ft. ..	$0.1318

The specifications for creosote approved by the American Railway Engineering Association are accepted as standard. Some form of boiling process is now used almost exclusively in the treatment. The boiling process was developed in 1892 by John D. Isaacs for the Southern Pacific Company, which treats a large percentage of the piles used in central and southern California. The process became generally known, and at present five of the six timber-treating plants in Oregon and Washington employ it.

In this process, which was designed primarily for treating Douglas fir, the artificial seasoning by boiling in oil is said to weaken the timber much less than the steaming process. After the piles are run into the treating cylinder on trucks, creosote at a temperature of 160 degrees Fahrenheit is introduced until the piles are covered and there is a space of 10 inches between the surface of the oil and the top of the retort. Steam is then admitted to coils in the cylinder and the temperature of the oil is raised to 220 degrees. The amount of steam is then regulated so as to maintain the temperature between 220 and 225 degrees until such time as the amount of condensation collected from the treating cylinder has decreased to ⅛ pound of water per cubic foot of timber per hour. After this the treating cylinder is filled with creosote at a temperature of 180 degrees and a pressure of 5 pounds per square inch is developed. Connection is then made with a measuring tank from which oil is pumped into the cylinder until an amount equal to 10 pounds for each cubic foot of timber has been injected.

Creosoted pile piers of the construction standard approved for the port of San Francisco by the Board of State Harbor Commissioners are usually estimated at $1 per square foot of completed pier, exclusive of bulkhead wall and sheds. This allows a margin for fluctuating prices of materials, as is shown by the fact that contracts for two piers have recently been let on a basis of 84 and 81.4 cents per square foot. On the basis of a cost of $1 per square foot the maintenance estimate in the accompanying table was submitted to the San Francisco Chamber of Commerce by a committee of three engineers appointed to investigate dock costs and governing conditions at the port of San Francisco.

It is apparent, therefore, that aside from any comparisons with concrete construction, creosoted piles can be expected to give satisfactory service under Pacific Coast conditions. Moreover, sufficient time has, probably, not elapsed to allow final judgment to be passed in the controversy between timber and concrete under these conditions, for, as above noted, piles which have been removed were giving good service after 22 years of use, while others are still in good condition after a period of 24 years.

By N. A. Bowers in Engineering Record.

Fire Prevention

Danger Zone—Building Codes—Private and Public Fire Extinguishing Appliances—Control of Occupancy Hazard—State and Municipal Laws

THE Committee on Fire Prevention of the American Society of Municipal Improvements (of which Mr. Alcide Chausse, Building Inspector, Montreal, is Chairman), presented at the convention of that society as its report, a statement of the resolutions adopted and discussions held at the First American Fire Prevention Convention. Omitting the introductory paragraphs, the report is as follows:

Topic No. 1—"Location" (Exposure Hazard).

Note—Every building, and its contents in life and property, must stand on some finite, geographical spot; and carry to, and receive from, its environing property measurable fire hazards—hence this fundamental unit consideration.

Resolution.—It is the sense of this convention that:

Fire is always local, originating from a definite cause in a definite property on a definite location; hence every building—in reasonable relation to its size, character, use and the congestion of its location—should be so constructed as to prevent the passage of fire from within to without and vice versa.

Topic No. 2—"Zones of Danger."

Note—The aggregate unit fire exposure becomes communal fire exposure—hence the consideration next in order of groups of unit exposures.

Resolution—It is the sense of this convention that:

Populous communities should be divided into danger zones; wherein rules reasonably limiting, defining and regulating the presence, form and use of property may be legally imposed, with due regard for the present and near prospective congestion of life and property in such areas.

Topic No. 3—"Building Construction."

Note—On any selected site the consideration next in order is the unit building fire hazard—in design, specification and construction.

Resolution—It is the sense of the convention that:

All building construction and reconstruction—having in view the present and near prospective congestion of its location and the range of occupancy proposed—should fully include in design, specifications, construction and appliances adequate safeguards against danger to life and property. All buildings should be required by law to be fitted with adequate fire exits and escapes proportioned to their human occupancy in accord with reasonable exit tests. Outside fire escapes are deemed the least desirable of all forms.

Topic No. 4—"Building Codes."

Note—The aggregate of unit building construction problems becomes the like community problem, or the Building Code (state or local).

Resolution—It is the sense of the convention that:

(a) All building construction and reconstruction should be under government control, state or local, to the end that the greatest safety for the greatest number for the present and future should be assured;

(b) Each of the several states should adopt a state building code with requirements which local governing bodies may raise but not lower by local enactment, said requirements to be enforced by proper governmental machinery.

(c) The classification of building construction is entirely one of relative ability to resist attacks by fire, and therefore in all building codes the term "fireproof" should be replaced by "fire-resistant," and ordinary frame construction should be classed as "combustible";

(d) The National Fire Protection Association is hereby requested to recommend approved standards of fire-resistant construction which may be used by states and municipalities in their respective building codes.

[Section (d) was subsequently modified in its force and intent by resolution adopted under Topic No. 8, "Compulsory Physical Standards," whereby the recommendations of the National Fire Prevention Association and other originators of standards are to refer same for approval to the Bureau of Standards of the Department of Commerce of the National Government at Washington.]

Topic No. 5—"Protection (Private)."

Note—The best located and constructed unit building is now held to need protection (usually water supply and/or chemicals) to reasonably assure safety against fire for the building itself as well as for its contents in life and property—hence this consideration comes next in order after the actual construction (often with it).

Resolution—It is the sense of the convention that:

(a) Every building—for its own safety and that of its contents in life and property—should be fitted reasonably, with respect to its location, character and use, with proper mechanical aids to discover, alarm and extinguishing fires and to resist lightning; and

(b) The occupants of every building should be reasonably educated regarding the physical structure thereof, and how to leave same in a quick and orderly manner, and be organized reasonably to fight fire therein.

Topic No. 6—"Protection (Public)."

Note—Communal fire protection is essential in addition to all like private unit agencies—hence this topic in this place.

Resolution—It is the sense of the convention that:

(a) All communities need physically a sure water supply, broadly usable by citizens for private fire protection, under the least onerous terms—also adequate fire-fighting apparatus with proper personnel to operate same; also an adequate alarm system—all proportionate to the character, area and population of each community; and

(b) All fire-fighting forces should be efficiently organized in enduring form, under legal control and disciplined when possible—their morale and requirements should be high and solely influenced by good service considerations; and the training should be constant and adequate for efficient fire-fighting and fire-prevention inspection and the purchase and maintenance of the valuable special mechanical apparatus.

Topic No. 7—"Equipment."

Note—It is necessary to heat, light, ventilate and otherwise "equip" every unit building wherever located; and this equipment is all productive, and/or receptive, of fire hazard—hence its appropriate consideration at this point.

Resolution—It is the sense of the convention that:

All equipment for buildings should be adequately designed and constructed with respect to its fire hazard—productive or receptive—and that its use should be predicated on reasonable compliance with such requirements, and should be reasonably regulated everywhere by law.

Topic No. 8—"Compulsory Physical Standards."

Note—If the thought is sound that reasonable enforced laws are necessary to control the purely physical problems of so constructing, protecting and equipping buildings as to abate fire waste, then it becomes of maximum importance to define uniformly and precisely the not unduly burdensome technical physical things required in such laws by the best experience—hence this consideration at this point.

Resolution—It is the sense of the convention that:

In view of the growth of state laws and municipal ordinances to prevent the appalling loss of life due to fire and to control fire waste by the widespread legal imposition of physical requirements upon construction, protection and equipment of buildings, it is now important that:

(a) Physical standards on this entire subject be formulated which may be generally and legally imposed without undue hardship or cost upon the public; and

(b) That the federal government through its Bureau of Standards of the Department of Commerce should arrange to review such standards for approval and promulgation in uniform language, to the end that they may be used by states and municipalities in laws and ordinances; and therefore be it further

Resolved:

(c) That the National Fire Protection Association be requested through its Executive Committee to arrange for a conference of delegates, with the chairman of this convention as chairman; from the American Society for Testing Materials, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, and all kindred national societies having standards bearing on this subject, for the purpose of collecting such standards for submission to the federal government; and be it further

Resolved:

(d) That the conference thus formed be requested to take the necessary steps to bring these resolutions before Congress and to secure the required legislation at the earliest opportunity.

Topic No. 9—"Occupancy" and Topic No. 10—"Annual Occupancy."

Note—Every use or "occupancy" of any building contains in itself an inherent fire hazard to that structure and its contents in life and property, and also to its environing community; hence consideration here of this danger in completed buildings.

Resolution—It is the sense of the convention that:

(a) The individual occupancy hazard (the relative fire hazard to life and property in any given building inherent in any given pursuit) should be definitely controlled as to construction by the building code; and as to management by proper police (or equivalent) continuous regulation to assure reasonable safety of life and property therein;

(b) The general occupancy hazard (the relative community hazard inherent in any given pursuit) should be definitely controlled in every populous community by law, which should exclude extra hazardous pursuits, and properly place and safeguard by appropriate rules permissible hazardous pursuits in their appropriate danger zone (or other like delimited area); and

(c) The control of occupancy conditions, through requirements imposed by law, is essential for the abatement of fire waste of life and property; and this control to be actual and effective should cover all property (at least in cities) and continuously at least once annually and upon every substantial change of occupancy through the agency of an occupancy license based upon competent local inspection by the fire-fighting force or an adequate similar agency.

Topic No. 11—"Management."

Note—The preceding topics all dealt almost exclusively with physical means to control and prevent fire waste. This topic considers the moral as well as physical subject of cleanly and orderly daily living in property and its beneficial influence in abating and controlling fire waste.

Resolution—It is the sense of the convention that:

Based on evidence and opinions obtainable approximately one-half of all fire waste—including avoidable fires without fraud as well as arson fires—arises from ignorant, shiftless, dirty and vicious use of property (which condition causes an approximate-like proportion of sickness and immorality in all populous centres) and therefore minimum continuing requirements as to clean and orderly living and the suppression of dangerous fire-breeding nuisances (such as the snap match, dangerous smoking, careless storage of rubbish, ashes, etc.) should be imposed by law in all communities, through the agency of the police power, acting through state and municipal fire marshal (or like officials), using the active fire-fighting organization for inspections as much as possible and all volunteer aid procurable.

Topic No. 12—"Legislation."

Note—This topic considers the need and scope of legislation to control fire waste.

Resolution—It is the sense of this convention that:

While fire loss of life and property is always local in inception, its result is national in effect, and hence its control must be effected by the operation of a sum total of state and municipal laws which will suppress the range of fire hazards to an attainable minimum everywhere and all the time; and that by this course alone can the sum total of fire waste of life and property be speedily and substantially reduced, and the cost of fire insurance (which reflects this total loss) be lessened throughout the country.

Topic No. 13—"Education."

Note—No programme can succeed unless understood by, and in sympathy with, the mass of people; hence consideration here of the problem of widely informing the nation about the physical phases of fire danger and waste and the imperative need of reasonable legal regulation on the subject.

Resolution—It is the sense of this convention that:

Education of the public about fire danger and waste of life and property should be provided in all laws, ordinances and regulations on the subject; and all interests concerned should not only join issue in collecting accurate and authoritative data, but make equal effort to disseminate this information regularly and continuously among all the people in readily understandable language, to the end that they may not only accept, but demand proper fire waste regulation and live in full accord therewith.

Topic No. 14—"Insurance."

Note—Despite all future effort and regulation some fire waste must continue, hence consideration here of insurance, or the distribution financially of this waste.

Resolution—It is the sense of this convention that:

(a) The several states, territories and provinces should not only assure that permissible fire insurance is stable financially, but that the form of contract should be as clear, brief, explicit and sound as possible and, as nearly as may be, uniform in substance in all these jurisdictions, to the end that all such policies permitted to issue throughout the country may equally and adequately protect all citizens, including the ignorant and inexperienced; and

(b) Said jurisdictions should as nearly as possible adopt uniform regulations governing:

1. Issuance of fire policies on property.
2. Licensing of fire insurance agents and brokers, and
3. Licensing of fire insurance adjusters:

To the end that only reasonable insurance contracts will be permitted on property and that only men of sound character will be admitted to the business of writing insurance and adjusting fire losses, thus discouraging arson and complicity with fraudulent losses.

A large amount of reconstruction is being carried out by the Montreal Tramways Company. The track in various parts of the city are being relaid and new [illegible] type 132 lb. rails put in. This is in accordance with the programme of improvements outlined by Mr. W. F. Graves, the chief engineer.

Patents and the War

By Stanley Lightfoot, Registered Patent Attorney, Lumsden Building, Toronto.

IN order to meet the need of manufacturers and inventors for information concerning their actual position in view of existing circumstances, a general review of the patent situation both here and in Great Britain is given, dispensing with technicalities which would only be misleading to anyone not well acquainted with the patent law.

In the first place the provisions which have been made in both Canada and Great Britain are almost identical, and in treating the requirements and provisions of the new order which has been passed under the War Measure Act, 1914, in this country, it may be taken for granted that the same applies on the other side of the water, excepting where otherwise referred to.

Patentees or applicants for patents who have volunteered for active service, or who for other reasons arising from the state of war, are unable to file such documents or do such other acts as are required by the Patent Office within a certain time, may be granted extension of time for the filing of such documents, the duration of such extension being governed by the particular conditions of the case. The extension may also be granted when it is shown that the documents could have been filed, but under the circumstances arising from the state of war this would be prejudicial to the rights or interests of the applicant or patentee.

It appears to be the general opinion that the annulment of patents held by or giving benefit to persons who are subjects of a state at war with His Majesty comes automatically into force and that every patent so held is now void. This is not so and only takes place upon request being made to the Commissioner by some person who intends to manufacture the patented article, or otherwise commercially promote the same in a manner calculated to be in the interests of commerce, either throughout the Dominion or locally. The Commissioner may annul a patent under the terms of this Act at his own discretion, however, without request if he deems it advisable.

Applicants for the voidance of a patent under this Act should present at the Patent Office, a petition, together with the prescribed fee of $10.00. The Commissioner will then, if he deems the application to warrant it, annul the patent, either totally or partially and retain the right to revoke such voidance or suspension at any time if necessary. Where the case demands, the Commissioner may require and impose certain terms and conditions.

Subjects of a state at war with His Majesty are also liable to have any of their proceedings on patent applications voided or suspended.

Provision is also made to prevent subjects of a state at war with His Majesty from making assignments of their patents for the purpose of avoiding the provisions of this Act and such assignments are liable to be declared invalid. Manufacturers purchasing German or Austrian patents, at the present time, should take particular note of this fact.

Several applications have already been registered by Canadian manufacturers for the annulment of patents under this Act and by taking full advantage of these provisions, the commercial activity of this country will be materially increased.

The British Patent Office has also made arrangements regarding documents intended for countries at war in which the lodging of patents may be difficult. These documents should be filed through the British Patent Office, when the Comptroller will date-stamp them and retain until such times as conditions would make it safe to forward to their destination by this means. Official evidence will be shown that the papers were fully executed and forwarded for filing on specified dates. Foreign renewal fees, etc., may also be paid in a like manner.

Personal Mention

Mr. F. N. Smith, Resident Engineer of Construction for the Canadian Northern Pacific Railway at Henningsville, B.C., has been elected a Member of the American Society of Civil Engineers.

Mr. A. F. Macallum, City Engineer of Hamilton, Ont., was elected First Vice-President of the American Society of Municipal Improvements at the annual convention of that body held recently in Boston.

Mr. D. R. Weber, Assistant Superintendent at Revelstoke, B.C., for the well-known Vancouver contracting firm of Messrs. Grant, Smith & Company & McDonnell, Limited, has been elected an Associate Member of the American Society of Civil Engineers

The New Chief Architect of the Department of Public Works

Mr. Edgar Lewis Horwood, A..R.C.A., F.R.A.I.C,. whose appointment to the position of Chief Architect of the Department of Public Works, at Ottawa, in succession to Mr. David Ewart, was recorded in our issue of October 7, was born in Monmouthshire, England, in 1868 and was educated at the St. John's College, Frome, and at the Prescott High School. He came to Canada in 1882 and studied architectural work in New York and Buffalo. He went into private practice at Ottawa in 1893 and continued until his appointment to the Federal position. Among the various important and attractive edifices at Ottawa which he has designed are the Carnegie Public Library, St. Luke's Hospital, Ottawa Collegiate Institute and Sun Life Building. From 1907 to 1909 he was President of the Ottawa Chapter of the Ontario Association of Architects. He is an Associate of the Royal Canadian Academy of Arts and a Fellow of the Royal Architectural Institute of Canada. He was gazetted a Captain in the 43rd Regiment, D.C.O.R., in April of this year.

Mr. E. L. Horwood.

Dr. Allan J. McLaughlin, Chief Sanitary Expert of the International Joint Commission, Washington, D.C., has been appointed City Health Commissioner of Massachusetts. It was Dr. McLaughlin, it will be recalled, who assumed charge of the sanitary survey work for the International Joint Commission which was created to study the pollution of the boundary waters between Canada and the United States and report upon methods of correcting such abuses as were found to exist, with special reference to the spread of typhoid fever. Among sanitary engineers the report of his survey of the Great Lakes, among other publications, is well known.

Mr. Frank W. Skinner, for many years Senior Associate Editor of the Engineering Record, is now associated in consulting practice with Mr. C. E. Fowler, of Seattle, Wash., specializing in bridge and structural steel work, foundations, and general civil engineering field construction methods. Mr. Skinner is established in new offices at 45 Broadway, New York City.

Mr. Alexander Potter, Consulting Engineer, New York City, whose name will be familiar to many of our readers as a contributor to this journal, presented a paper relating to the sewage treatment plant at Moorestown, N.J., at the Twenty-first Annual Convention of the American Society of Municipal Improvements held at Boston. An abstract of Mr. Potter's paper is given elsewhere in this issue.

Lt.-Col. Mitchell's Important Appointment

Lt.-Col. C. H. Mitchell.

Mr. Chas. H. Mitchell, the well-known Toronto consulting engineer, who was formerly Intelligence Officer of the headquarters of the Second Division at Toronto, has been promoted to the rank of Lieut.-Col., and appointed General Staff Officer on the Headquarters Staff of the First Contingent. The appointment given to Lieut.-Col. Mitchell is one of the highest honors in the offering of the Canadian Militia.

Mr. H. A. McLean, City Engineer of Sarnia, Ont., is terminating his engagement with the city at the end of this month.

Mr. A. Chausse, Building Inspector of Montreal, was a visitor at the annual meeting of the American Society for Municipal Improvements at which he read a paper on "Fire Prevention."

Mr. R. M. Milan, Saskatoon, has been appointed electrical superintendent of the Dominion Government interior storage elevator at Moose Jaw. Mr. Milan will have charge both of the installation and operation of the elevator.

Mr. Ralph Modjeski, of Chicago, has been retained as consulting engineer on the [illegible] bridge at Vancouver, B.C., filling the place [illegible] by the [illegible] of Sir John Wolfe Barry. Messrs. [illegible] of Vancouver, are handling the matter locally as resident engineers.

Mr. Geo. Janin, Chief Municipal Engineer of the city of Montreal, has been busily engaged in organizing an engineering corps for active service in Europe. At the last word, Mr. Janin had received applications from some three hundred prospective recruits. Drills are already being held. It is of interest to note that sixty-five of Mr. Janin's applicants are of Belgian nationality. Of the total number of recruits, one hundred are employed by the Corporation of Montreal.

Mr. Jas. White, Assistant to the Chairman of the Commission of Conservation, Ottawa, advises us that the Commission has engaged the services of Mr. Thos. Adams, late Senior Town Planning Adviser to the Local Government Board of Great Britain. Mr. Adams is a recognized authority on his subject and is regarded as the foremost man in the profession in the Old Country. (Erratum.—In our issue of October 14 it was erroneously reported that Mr. Thos. Mawson had been engaged by the Commission).

Mr. George W. Coburn, district engineer of the Canadian Pacific Railway at Souris, Man., has been appointed district engineer at Brandon, Man. Mr. Coburn started work for the Canadian Pacific in 1896 as rodman and draughtsman at Franham, Que. From 1900 to 1902 he was engaged on construction work on various parts of the system, and in 1902 became assistant district engineer and draughtsman at Souris. He later served in similar capacity at Brandon and at Moose Jaw, Sask. Since 1907 he has been district engineer at Souris.

Mr. Chas. A. Tilden, for many years identified with civil engineering work in Canada, died recently in Chicago.

Mr. Harry B. Curtis, contractor, who had been in business at Medicine Hat for the last five years, succumbed recently from injuries received in an automobile accident.

St. John, N.B., Prosperous

FROM St. John, N.B., we are in receipt of encouraging reports concerning business and manufacturing conditions. Almost all the manufacturing concerns are running full time and some are working over time. Particularly is this the case in the woodworking industry. Messrs. Murray & Gregory, Limited, who employ 250 hands, are doing night work in some of their departments, while Messrs. Campbell Brothers, axe and edge tool makers, record an increased demand for high grade goods. One firm manufacturing boxes and box shooks, another firm of wholesale shoe dealers, and still another firm of bedding manufacturers, find much encouragement in the outlook. We mention these facts to show the manner in which business activity is distributed in the constructional field.

Announcement is made that the Intercolonial Railway has taken over the Valley Railway. This will mean additional railway projects at an early date.

In the building line construction has commenced on the new tuberculosis hospital. On St. James Street a large Salvation army Shetler is to take the place of the Metropole which was destroyed by fire last year.

Recently the City Council invited the citizens to subscribe to a bond issue of $24,000 for public improvements. Within a short time nearly double the amount required was subscribed.

The Hamilton Board of Trade is strongly in favor of the construction of the proposed bridge which would pass over the Valley line [illegible] when the Hamilton-Toronto concrete roadway is built. The sub-committee on good roads has obtained an estimate from the Hamilton Bridge Works on the cost of such a bridge, the figure obtained being [illegible] for a bridge [illegible] feet in length. Another plan for a bridge slightly over [illegible] feet long will be submitted to the bridge works shortly for an estimate. Mr. D. B. Wood is President of the Hamilton Board of Trade

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

The Western Foundation Company of Canada, Limited, has been incorporated at Toronto with a capital of $200,000.

The Canadian Shipbuilding & Drydock Company, Limited, Owen Sound, Ont., has been incorporated with a capital of $2,000,000.

In answer to several enquiries, we may say that no appointment has yet been made to the vacant city engineership of Ottawa. Mr. F. C. Askwith is Acting City Engineer.

A new sewage disposal plant for the east end of the city of London, Ont., is under consideration. Plans have been prepared by Mr. Willis Chipman, consulting engineer, Toronto.

Plans are being prepared for a furniture factory which Mr. J. E. Baechler proposes to erect at Goderich, Ont., at a cost of $50,000. The architect is Mr. J. Fowler, Goderich, Ont. Work has not yet started.

Foundation work is under way for a new school on Dundurn Street, Hamilton, estimated to cost $100,000. The building is to be two storeys high, of brick construction. Messrs. Stewart & Witton are the architects.

Mr. Norman McLeod, the contractor for the construction of the filtration system which the city of Montreal is installing at a cost of $1,000,000, has been granted an extension of one year for the completion of the work.

Foundation work has been completed for a six-storey reinforced concrete apartment house building which is to be erected on Bay Street South, Hamilton, at a cost of $100,000. The architects are Messrs. Stewart & Witton.

Operations are proceeding on the erection of the new St. Francis R. C. Church on Grace Street, Toronto. The building is of stone, steel and brick construction and is costing $100,000. The architect is Mr. A. W. Holmes, Toronto.

Exterior work on the addition to the University of Ottawa is nearing completion. The work upon completion will cost $150,000. Mr. C. P. Meredith, Ottawa, is the architect, and the contractors are Messrs. C. E. Deakin, Limited, of Montreal.

Lloyd, Blackmore & Company, Limited, have been appointed architects for the Smiths Falls Aluminum & Brass Foundry Company on a building which will cost in the neighborhood of $15,000. They expect to call for tenders in the near future.

The township of Barton (Hamilton) is contemplating the installation of a sewerage system. An outline of the scheme has been prepared by Mr. A. F. Macallum, City Engineer of Hamilton and Mr. A. Nicholson, Township Engineer of Barton.

At North Bay there is under construction a new building for the French Roman Catholic church. The basement only will be completed this season. The main building will probably be started next spring. The estimated cost of the church is $100,000.

At Montreal, the Board of Control has decided to carry on all public work possible in order to provide for the unemployed. It is stated that work in sight will provide labor for 10,000 men for six weeks from November 1st. The rate of wages will be $2.50 a day.

At a meeting of the Canadian Railway Club, Montreal, Mr. G. E. Smart, master car builder of the Intercolonial Railway Company, read a paper on "Wood Frame Cars in Freight Trains of Today." Mr. L. C. Ord, assistant master car builder of the C. P. R., presided.

Building operations are to commence shortly on the proposed public market at Maisonneuve, plans for which have been prepared by Mr. M. Dufresne, Montreal. The building, which is estimated to cost $100,000, will be 2½ storeys high, of brick, granite, and stone construction.

Of the new work in progress for the Canadian Vickers Limited, at Montreal, mention may be made of an engine and boiler house estimated to cost $165,000. The new plant is being erected according to the plans of Sir Wm. Arrol, of Glasgow, Scotland, and the general contractor is Mr. E. G. M. Cape, Montreal.

The new Customs House at Fort William, Ont., which is being erected for the Dominion Government by Contractor W. Braden at a cost of $175,000, is making good progress. The exterior work is now nearing completion. The building will be three storeys high, of reinforced concrete, stone and brick construction.

At Ottawa, steel work is in progress on the new church which is being erected on Fairmont and Wellington Streets by the Capuchin Fathers. The building, which is to be of stone construction, will cost $156,000. The architect is Mr. Chas. Brodeur, of Hull, Que., and the general contractors are Messrs. Noel & Monette, Ottawa.

The new chain factory at Niagara Falls, Ont., erected for the Dominion Chain Company according to plans prepared by Mr. E. D. Pitt, is nearing completion. The plant, which has cost $150,000, has been erected by Messrs. S. Austin & Sons, Cleveland. The building is two storeys high, of reinforced concrete construction.

Building operations have commenced on a new edifice at the corner of Lowther Avenue and St. George Street, Toronto, for the First Church of Christian Science. The estimated cost is $100,000. Mr. S. S. Beman, Chicago, is the architect, and the general contractors are the Sutherland Construction Company, Limited, Toronto.

At Sherbrooke and Montcalm Streets, Montreal, building operations are to start on a new library building estimated to cost $200,000. Detail plans are not completed and the contract is yet to be approved by the city council. Mr. E. Payette, of Montreal, is the architect, and the Foundation Company, Limited, have the contract for the foundations.

As previously reported in this journal, work is in progress at Toronto on a factory building, estimated to cost $1,250,000, for the Canadian Kodak Company, Limited, Toronto. The plant will consist of five reinforced concrete buildings. The general contractor is Mr. C. E. Deakin, Montreal, while the architect and engineer is Mr. C. K. Flint.

Charlottetown, P.E.I., reports plasterng work in progress on the new church which is being erected for St. Dunstan's R. C. Cathedral at a cost of $200,000. The new building, progress on which has been reported in these columns from time to time, is of steel, brick and stone construction. The general contractors are Messrs. J. S. Metcalf Company, Montreal.

At a meeting of the special committee appointed recently by the various municipalities interested in the project of constructing a permanent roadway from Toronto to Oshawa, it was decided to ask the provincial government to make a survey of the road and estimate the cost of a 16-ft. concrete roadway with gravel shoulders and a concrete base 7-in. thick. The estimated cost is $170,000.

Fraser, Brace & Company, the contractors for the hydro-electric plant of the Cedars Rapids Manufacturing and Power Company, have nearly finished their contract, and it is probable that the latter concern will begin supplying power early next year. The work of constructing the canal is finished, the power house is complete, and all the heavy machinery has been installed. The two transmission lines, one to Montreal and the other to Messena, N.Y., are well on their way to completion.

At Ford City, Ont., a new factory is being erected at a cost of $300,000 for the Ford Motor Company of Canada. The building is to be six storeys high, 200 ft. x 195 ft. in dimensions, of steel and reinforced concrete construction. The architects are Messrs. John Graham & Company, of Windsor, and the general contractors are Messrs. Wells & Gray, Toronto. The Canadian Bridge Company, of Walkerville, have the contract for the steel work.

WESTERN CANADA

Plans for the proposed grain elevator at Vancouver have been completed and it is understood that tenders for the erection of the building will be called shortly.

Tenders are to be invited shortly for a new 8-roomed school building at Point Grey, B.C. The building will be of reinforced concrete, stone and brick construction. The estimated cost is $50,000.

At a meeting of the Manitoba Branch of the Canadian Society of Civil Engineers held recently in Winnipeg, Mr. W. G. Chace gave an outline of the work done in connection with the Shoal Lake water scheme.

The new Provincial Parliament Buildings at Winnipeg, now in course of construction, are up two storeys. The dimensions of the building are 340 ft. x 320 ft. and the estimated cost is $2,000,000. The architect is Mr. F. W. Simon and the general contractors Messrs. Thos. Kelly & Sons, Winnipeg.

November 30th is the closing date for submitting competitive designs for the proposed Civic Centre at Vancouver. The authors of the designs placed first and second will be awarded premiums amounting to $500 and $250 respectively. The Secretary of the Vancouver Civic Centre Committee may be addressed at 543 Hastings Street West, Vancouver.

Sewage extensions at Vernon, B.C., involving an expenditure of $100,000, are about to be placed under construction. Messrs. DuCane, Dutcher & Company, Vancouver, have been appointed consulting engineers for the White Valley Irrigation System and are at present carrying out the proposed extensions. An outlay of $500,000 is involved in the whole project.

At a meeting of the provincial legislature held at Edmonton, Alta., the Premier [illegible] particular interest to the north country. The resolution makes special provision for the building of the Central Canada line to Peace River Crossing, or thereabouts, and will, if assented to by the House, bring the navigation of that important river, with its rich tributary districts within easy travelling distance of Edmonton.

At Edmonton, while municipal engineering work has been somewhat curtailed [illegible] the expenditures in the [illegible] fairly heavy this season. The following is a statement f work totalling in value $1,776,000, which has been actually carried out or put in hand:—boulevards, $31,298.59; grading, $4,511.92; concrete sidewalks, $83,641.20; paving, $211,329.38; plank sidewalks, $47,366.58; sewers, laterals, $402,494.43; sewers (trunks), $930,581.74; water mains, $64,355.81.

Field work on the Greater Winnipeg water scheme is progressing satisfactorily according to the latest progress report. The following details of general work are given:—Contract No. 6, completed telephone line, permanent construction, 49 miles; temporary [illegible] 91 miles. Contract No. 5, steel rails, 8,716 tons received to date of a total order of 9,350 tons. Contract No. 7, splice bars, 1,004,176 lbs. 100 per cent. complete. Railway construction, common excavation, 70 per cent. of the estimated quantity; track laying, 40 per cent. of the main line; ballast, 33 per cent. of probable requirements; train hauled filling, 20 per cent. of the estimated quantity; fencing, 41.7 miles. Contract No. 10, clearing right of way, 2,600.682 acres, contract completed. With regard to the Falcon River dyke, it was reported that the progress required was 60 per cent., and the progress made was 69 per cent., so that the contractors were well ahead with the work. Work has also commenced with ditching from Indian Bay to Snow Shoe Bay. Forty per cent. of station buildings have been completed, 20 per cent. of the superintendent's house, 90 per cent. of two cottages and 50 per cent. of a third, and 95 per cent. of the pumping house. There were 1,165 men engaged in the work, and 54 horses.

Constructional Activity at Regina

The action of the city of Regina in proceeding with the construction of improvement works has had a reassuring effect upon constructional activities in general. Several large buildings are now in course of construction, and others will be commenced in the near future. Among the new buildings proposed is one for the Regina I. O. F. Lodges; another is a church building for the Wesley Methodist congregation, and another is a Labor Temple for the trades unions.

The Saskatchewan Co-operative Elevator Company, with headquarters at Regina, are having their new office building rushed through to completion as quickly as possible. This building is 125 ft. by 100 ft. in dimensions.

The city of Regina has decided to rush through to completion the construction of a 5,000,000 gallon reservoir. At the present time about sixty-five carpenters and eighty laborers are employed on the work. At the base, the concrete walls are 2 ft. 9 in. thick, tapering to 1 ft. at the junction with the roof. This wall is to be reinforced with a brick veneer 1 ft. in thickness above ground level.

The new Regina power-house is rapidly nearing completion. If the work progresses as rapidly in the future as in the past the building will be completed within a month. The cost will be approximately $170,000. The cost above ground was $90,000, in addition to $36,000 for steel. The foundation and ground floor were constructed by the city by day labor at a cost of $40,000. Up to the present, nearly $100,000 worth of machinery has been installed.

From the Link-Belt Company, Chicago, we have received a copy of the 1914 edition of their book, No. 124, entitled "Steel Chains." The firm's products are described and illustrated very clearly. Details as to size and construction are given in tabular form. The chains are listed in the order of strengths and a numerical index facilitates reference.

From Mr. Stanley Lightfoot, Registered Patent Solicitor and Attorney, Toronto, Ont., and Washington, D.C., we have received an informative booklet dealing with patents, designs and trade-marks. The various ways in which industrial protection is obtained are explained fully and the information [illegible]

The Pedlar People, Limited, of Oshawa, have been [illegible] ley Irrigation & Power Company of British Columbia. The material is to be used in the completion of the Grey Canal and the order—which is one of the heaviest for this kind [illegible] feet, varying in diameter from 61-in. to 30-in. The contract [illegible]

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Barton Twp., Ont. (Hamilton)

Reports estimating the total cost of installing a sewerage system on the mountain in the Township of Barton; also in the east end have been submitted by Mr. J. B. Nicholson, Twp. Engineer. The estimated cost of the former is $357,863 and of the latter $161,664.

Berlin, Ont.

The City Council will construct storm sewers on John Street, providing the necessary funds can be raised. Mr. Herbert Johnston is the engineer.

Brantford, Ont.

A committee of the City Council have requested permission of the Provincial Government to proceed at once with work on Boulevard Drive, estimated cost of which is $27,000. Mr. T. H. Jones is the engineer.

Halifax, N.S.

Tenders will be received by Mr. E. H. Armstrong, Halifax, Commissioner of Provincial Government Department Public Works, until noon, November 2nd, for construction of 107 culverts in Shelbourne Count on road around Cape Sable, approximately 17.57 miles long. Plans and specification are at offices of postmasters, Clark's Harbor, Shelbourne and Barrington, and at the Department, Halifax.

Hamilton, Ont.

Work is under way on construction of sewers, the contract for supplying piping at $16,000 having been obtained by McAllister & Company, Standard Bank Bldg., Toronto.

Hawkesbury, Ont.

The Municipality of West Hawkesbury has in contemplation the construction of a crushed stone road estimated to cost $2,000. Mr. F. Stidwell, Cornwall, is the Engineer.

Kingston, Ont.

A deputation representing all municipalities between Toronto and Oshawa, with the exception of Toronto, waited on members of the Provincial Government recently to request the appointment of an engineer to make a survey of the cost of a 16-ft. concrete roadway with gravel shoulder, 4 ft. in width, and of estimated division of cost of this and a macadamized road over the same area. The Government granted the request for an engineer's survey.

London, Ont.

The erection of a municipal Sewage Disposal Plant for the east end of the city is contemplated by the City Council. A site for the plant is at present being selected.

Ottawa, Ont.

The City Council has in contemplation the construction of a 12-in. water main on Bank Street at an estimated outlay of $12,000.

The City Council is inviting tenders for the construction of asphalt pavement on Booth Street between Somerset and Queen Streets, estimated to involve an outlay of $32,500. The following are the approximate quantities:—asphalt, 9,440 sq. yards, water table 2,650 sq. yards, gutter 4,500 lin. feet, headers 350 lin. ft. Mr. F. C. Askwith is the City Engineer.

Work is to start by day labor on pavement work on Bank Street at an estimated outlay of $96,000. Mr. F. C. Askwith is the engineer.

The City Council is about to carry out rock grading between Carling and Earnest Streets at an estimated outlay of $3,000. Work will be carried out by day labor. Steam drills and rock equipment are required. Mr. F. C. Askwith is the Engineer.

Stratford, Ont.

The Board of Works has approved all plans for construction of sewers and culverts. Tenders will be called next spring. Mr. A. B. Manson, City Hall, is the Engineer. Mr. J. A. Gray, Secretary.

A by-law authorizing the construction of a Crushed Stone and Macadamized roadway on Ontario Street, from Queen Street to City Limits, has been carried. Mr. A. B. Manson, City Hall, is the engineer.

St. Marys, Ont.

The Town Council has decided to expend about $1,900 on cement curbs and gutters for four blocks. Mr. Thos. M. Clarke, Town Clerk.

Toronto, Ont.

Tenders will be called shortly for the laying of about 1,000 ft. of 72-in. steel conduit from reservoir to filtration plant, Toronto Island. Mr. R. C. Harris, City Hall, is the Commissioner of Works.

Vankleek Hill, Ont.

The construction of gravel road by day labor at an estimated cost of $1,000, is contemplated by the municipality. Mr. W. H. Magwood, Cornwall, is the engineer.

Vancouver, B.C.

A recommendation has been made that the City Council proceed with the construction of sewers on six streets. It is reported that the work, which is estimated to cost $25,000, will be carried through by day labor. The Engineer is Mr. F. L. Fellowes.

CONTRACTS AWARDED

Hull, Que.

The contract for construction of cast iron water main extension on several streets has been awarded to Gendron & Wilson. The engineer in charge of the work is Mr. J. A. Laforest.

Toronto, Ont.

The contract for laying sidewalks on Dundas Street has been awarded to the Grant Contracting Company, Toronto, at $690, and to Godson Contracting Company, Manning Chambers, at $2,531 for pavement on Heath Street.

Winnipeg, Man.

Mr. J. W. Astley, Engineer of Construction, has been given the contract for construction of plank sidewalks on Mulvey, Bannerman and Higgins Avenues and Academy Road, at $1,772. Board of Control will invite tenders shortly for construction of granolithic sidewalks on Derby Street (2 sides), Spence, Austin and Helen Streets, at an estimated cost of $5,263.

The contract for construction of plank sidewalks on Machray Avenue, Charles Street, Oak Street, Sherburn Street, Warson Avenue E., and McMillan Avenue has been handed over by the Board of Control to Mr. J. W. Astley, Engineer of Construction.

The following contracts for paving work have been awarded by the Board of Control:—6 granolithic sidewalks on Canora Street, $157.50; asphalt No. 2 pavement, 24-in. wide, on Oxford Street, (approximately 680 ft.) $4,499.55; Ruby Street, $4,284.50 and Banning Street, $17,627.30. Mr. J. W. Astley, Engineer of Construction, is the general contractor. Mr. W. P. Brereton is the engineer.

Railroads, Bridges and Wharves

Brantford, Ont.

The Lake Erie & Northern Railway has been authorized by the Railway Commissioners to construct a bridge across the Grand River in this district.

Glenmorris, Ont.

The Railway Commissioners have given their approval to the location of a station for the Lake Erie & Northern Railway.

Luxon, B.C.

The Canadian Pacific Railway is erecting a station at this point 54.3 miles south of Golden on Kootenay Central Lines. The location has been approved by the Railway Commissioners.

North Vancouver, B.C.

The Pacific Great Eastern Railway, Vancouver, has had plans drawn for two stations to be erected on Fell and Pemberton Avenues. Tenders for the work will not be called for some time.

Province of Alberta

The G. T. P. Branch Lines Company is constructing a spur for Todfield Clay Products Company.

The C. N. R. is constructing a spur to the property of Pembina Coal Company, Limited, a spur to Worswick Paving Company, Limited, Edmonton, and to the location of the Slocum Coal Properties.

The C. P. R. will construct additions and alterations to spurs from Western Canada Flour Mills Company, Calgary; a spur and branch for the Maple Leaf Milling Company, Medicine Hat; a spur for Hewitt & Black, Limited, Medicine Hat, and also for McDonald Construction Company, Limited, Calgary.

Province of British Columbia

The Canadian Pacific Railway will construct a spur for the accommodation of the Ross-Saskatoon Lumber Company, Limited, East Kootenay District. The scheme will be carried through by the end of November.

The Grand Trunk Pacific Railway have decided to construct a spur to serve Inverness cannery at Mileage 12.8. Prince Rupert.

Province of Ontario
The C. N. R. has decided to construct a spur line to Ballast Pit, Vanhorne, Main Line, also into the premises of James Harty and L. J. Marsh, Fort Frances.

Southport, P.E.I.
Work has been started on dredging preparatory to construction of two marine slipways, each of which will be 400 ft. long, 150,000 sq. yds. shore front are to be dredged and construction of slipways will be started next spring. The general contractor for the Dominion Government Department of Public Works, is Mr. V. T. Bartram, Toronto.

Toronto, Ont.
Plans have been prepared by Mr. R. C. Harris, Commissioner of Works, City Hall, for Rosedale section, Bloor Street Viaduct. Tenders for construction of this section are expected to be called for shortly by the Board of Control.

Vancouver, B.C.
The Union Steamship Company has made a proposal to the Civic Bridges and Railways Committee to construct a bridge over the C. P. R. tracks to Union wharf. The company has been asked to submit plans for approval.

Woburn, Ont.
The Scarboro Twp. Council has in contemplation the construction of a new bridge over Rouge River. Mr. Thos. Crawford, Agincourt, Ont., is Clerk.

Public Buildings, Churches, and Schools

Arundel, Que.
The Secretary-treasurer, School Board, (Mr. C. J. Staniforth), will receive tenders until November 7th for supply of material and erection of school building, plans and specification in connection with which are at office of secretary-treasurer.

Bassano, Alta.
Excavating work is being completed on $35,000 post office and customs house for Dominion Government Department Public Works. The building will be two-storey, 45 x 65, steel and brick construction. Mr. M. C. Sackrider, Main and South Railway Streets, Medicine Hat, is the general contractor.

Belleville, Ont.
The Methodist Church Congregation has had plans drawn for a brick addition and interior structural alterations to church building at an estimated cost of $11,000. Mr. J. P. Miller is the architect and Mr. R. P. White, Grove St., general contractor.

Tenderers for interior fittings are requested to apply to Belleville Club, Limited, in reference to refitting of building on Bridge and Pinnacle for Club. Estimated outlay $7,000.

Cote des Neig's, Que.
All sub-contracts have been awarded on $20,000 bank, three-storey [illegible] brick construction, in course of erection for Molsons Bank. Mr. L. A. Amos, 78 Crescent Street, is the [illegible]

Charlottetown, P.E.I.
In regard to the sanitarium [illegible] been erected in North Wellshire for the Provincial Government Department of Public Works at an estimated cost of $30,000, hospital furniture has not yet been purchased. Tenders will not be called on this for some time. Mr. W. F. Fidmarch, 8 Brighton Road, is secretary.

Edmonton, Alta.
The contract for construction of cathedral on Second Avenue, N.W., for R. C. Denomination, has not yet been awarded. Excavating is about completed and work will shortly be stopped for the year.. Mr. R. W. Lines, Canada Permanent Building, is the architect, whose plans call for a building .30 x 120, brick and terra cotta construction.

Hamilton, Ont.
The City Council has had plans approved by the Provincial Health Inspector for $200,000 hospital, but these have yet to be ratified by a New York expert. Tenders for foundation work will be invited shortly. Other tenders will not be called until next spring. Hospital building will consist of three storeys and will be provided with three wards. Messrs. Stewart & Witton, 2 Hughson Street South, are the architects.

Tenders are in for building of $25,000 Church on Ottawa Street for St. James' Anglican Congregation. Building will be brick construction, stone trim. It is said that the contract will not be awarded until next spring. Mr. W. Grayson Brown, Clyde Block, is the architect.

Harrow, Ont.
The Methodist Church in this town is to be remodelled, including decoration of interior, alterations to pulpit, choir loft, also installation of new fixtures and construction of shingle roof.

Hespler, Ont.
The sub-contract for cut and ornamental stone in connection with town hall estimated to cost $35,000, for the Town Council, has been awarded to the Corinthian Stone Company, G. T. R. Junction. Gill Bros., Queen Street, are the general contractors; architects, Evans & Fulford, Scott & Bennett Block. Building will be 70 x 55, brick construction and artificial stone trim.

Mount Dennis, Ont. (Toronto)
The ratepayers have authorized the trustees of S. S. No. 28, York Township, to erect a four-room school at Mount Dennis. The architect has not yet been chosen. Mr. J. Marshall, Weston Road, Mt. Dennis, is Secretary of School Board.

Mulmur, Ont.
The trustees of school district No. 19 will purchase furnishings for school. W. J. Laidlaw, Primrose, Ont., is the [illegible]

New Westminster, B.C.
[illegible] Construction Company, general contractors, Northwest Trust Building, Vancouver, are asking for figures [illegible] Mr. J. E. Griffith, Vic[illegible] ner & Mercer, West Trust Block, are the architects.

North Vancouver, B.C.
[illegible] been awarded in connection with the $120,000 two-storey brick and reinforced concrete Central School building on Keith Road and 8th Street, for School Board. Mr. W. C. F. Gillam, Northwest Trust Building, is the architect, and W. J. Smith, Limited, 602 Hastings West, are the general contractors.

Port Whitby, Ont.
The ratepayers have voted in favor of the expenditure of $6,000 for the construction of a two-room school.

Regina, Sask.
The congregation of St. Chads has had plans completed for construction of $50,000 church on 7th Avenue and Garnet Street. Dimensions, 125 x 50, brick and stone construction. Work will be deferred until spring. Mr. J. H. Puntin, 308 Darke Block, is the architect.

St. Thomas, Ont.
The Sisters of St. Joseph have purchased a residence which will be remodelled and converted into a sanitarium and hospital.

Toronto, Ont.
Tenders close with the architects, S. B. Coon & Son, Ryrie Bldg., on November 5th for construction of $60,000 school in East Toronto for school section No. 15, York Township. J. D. Young & Son, 160 Rusholme Road, invite estimates on all trades in connection with building, which will be two storeys and basement, 130 x 80, ten rooms.

Tenders close October 30 at 4 o'clock, with Mr. W. C. Wilkinson, Sec.-Treas. Board of Education, for electrical work on Harbord Street Collegiate, cabinet work on Oakwood Collegiate and Parkdale Collegiate, metal cupboards and lockers, weather strips, composition floors, steel and glass partitions.

The Board of Education will receive tenders until October 30 at 4 o'clock, for addition to Roden School building. Steel and brick construction, tar and gravel roofing, etc.

The Board of Education will receive bids until October 30 at 4 o'clock for addition to Ryerson School Annex. Steel and brick construction, tar and gravel roof, etc.

West Point Grey, B.C.
The architects, Messrs. Twizell & Twizell, Metropolitan Bldg., Vancouver, will receive tenders until November 6th for construction of $50,000 school building to consist of eight class rooms, three staff rooms, assembly room, two lunch rooms and medical inspection room. Building will be 100 x 92, reinforced concrete construction, Gothic style of architecture. Plans and specification are at office of the architect.

CONTRACTS AWARDED

Hamilton, Ont.
The Board of Education has awarded the contract for carpentry work on two-storey brick school building on Dundurn Street at an estimated cost of $100,000, to D. M. Campbell, Hamil[illegible] Hughson Street S., are the architects

The sub-contract for roofing and supply of blackboards in connection with [illegible] School, on which excavation work has [illegible] construction. Mr. A. W. Peene, 107 Clyde Block, is the architect. P. H. Foster, Secretary, Board of Education.

Business Buildings and Industrial Plants

Brockville, Ont.
The Brockville Opera House Company, [illegible] damaged by fire.

Blenheim, Ont.
[illegible] $1,000 has been sustained by Mr. John Cameron, South Harwick, in destruction by fire of a barn.

Brockville, Ont.
Plans have been drawn by Mr. A. Stuart Allaster, King Street, for alterations to the Albion Hotel at an estimated outlay of $2,500 for Mr. H. Garbutt, [illegible]

Copper Mountain, B.C.
The B. C. Copper Company, Copper Mountain, B.C., are having plans prepared for erection of a plant capable of treating 1,000 tons of ore daily. The plant at Greenwood is to be moved to Copper Mountain. Mr. Walz is the superintendent.

Fort George, B.C.
Tenders closed in July for contract to build $50,000 brewery for the Peace River Malting & Brewing Companv, Limited, but owing to financial stringency the contract has not yet been awarded. The building will be 5, 3 and two-storey, mill construction. Messrs. Wilson & Wilson, 532 Granville Street, Vancouver, are the architects.

Goderich, Ont.
Plans have been prepared for the construction of a $50,000 furniture factory for Mr. J. E. Baechler, North Street. The work of erection has not yet been started. Mr. Jades Fowler, Box 171 Post Office, is the architect.

Hamilton, Ont.
Concrete work has been started on first building, three storeys and basement, and excavating has commenced on second building of four storeys in connection with $1,000,000 soap factory in course of construction on Burlington Street for Proctor & Gamble Company. Buildings will be reinforced concrete, hollow tile, steel and brick construction.

Hawkesbury. Ont.
Paper and board mill, which is to be constructed for Hawkesbury Board & Paper Mills, will not be erected this year.

Kingston, Ont.
Mr. C. Schnell, of Paterson, N.J., is reported to be contemplating the construction of a Feldspar plant at this city.

London, Ont.
Office building, construction of which is in progress for Dominion Savinugs Company at an estimated cost of $65,000, is to be completed in November. Building will be four storeys, 145 x 109, reinforced concrete, brick construction, marble tile.

Hardware store at Talbot Street has been destroyed by fire. The owner, Mr. J. Brownlee, will rebuild as soon as possible. The loss is covered by insurance.

Maisonneuve, Que. (Montreal)
Work is to start on construction of bench for public market on Ontario Street for the Town Council. The contract for making a granite bench has been obtained by J. Brunet, 657 Cote des Neigs Street.

Medicine Hat, Alta.
Alberta Linseed Milling Company sustained loss reported at $20,000 in the destruction of mill by fire. It is not known yet whether the company will rebuild.

Montreal, Que.
A drug store belonging to Glasgow Drug Hall, Notre Dame W., has been damaged by fire. First two floors were completely destroyed. Loss approximately $20,000.

Architect W. B. McLean, 204 St. James Street, will call for tenders shortly for electrical work and elevators in connection with erection of four-storey, 160 x 80, brick factory on Beaumont Street, at an estimated cost of $32,000, for Martin Senour Paint Company, 655 Drolet Street. Reid, McGregor & Reid, Drummond Building, are the general contractors.

Moose Jaw, Sask.
The City Council has in contemplation the extension of its water-works system at an estimated expenditure of $10,000. Mr. Geo. E. Mackie, engineer, has recommended the erection of a filter station on South Hill to use water from Snowdy Springs. Mr. E. B. Bonnell is City Clerk.

Moncton, N.B.
Temporary repairs have been made to freight shed building which was damaged by fire recently. New building will be erected next spring by the owners, Dominion Government Department of Railways and Canals.

Newmarket, Ont.
The loss of $3,000 was sustained by Jesse Macauley, Botsford Street, owing to fire in brick veneer store. Loss was insured.

Ottawa, Ont.
Foundations have been started in connection with offices and printing works to be erected on Dalhousie Street for LeTemps Printing Company. A. Carpentier, 121 Main Street, is general contractor.

Plans are in progress and the architect, Mr. C. S. Burritt, Booth Building, is receiving tenders for heating and plumbing in connection with alterations to Nicholas Street Hotel.

Regina, Sask.
The contract to lay steam pipes under lane, west of building on 12th and Scarth Streets, to heat Aldon Block for McCallum Hill Company, Limited, has been awarded to Regina Plumbing & Heating Company.

This city has granted a six months extension on option of site for two-storey, 125 x 50 warehouse for Gutta Percha Rubber Company, Limited, Toronto, estimated to cost $20,000. Building operations are expected to commence at end of that period.

An extension of six months has been granted to Tudhope, Anderson & Company, Regina, by City Council, in order to commence building operations on $20,000 implement warehouse, which will be two-storey, 125 x 50.

Stratford, Ont.
The City Council has passed by-laws providing for $36,000 to recoup the Water Commission for money expended on extensions of mains in the city.

St. John, N.B.
It is reported that construction work on new $40,000 car barn for St. John Street Railway Company will be discontinued during the winter.

St. Hyacinthe, Que.
The ratepayers of this town have defeated a bylaw to authorize the erection of a $10,000 artificial stone factory for Mr. Frederick Dienlefet, Roxton Falls, Que.

Toronto, Ont.
Plans have been prepared for the construction of a machinery hall at Exhibition grounds, for the C. N. E. A. at an estimated cost of $145,000. The structure will be concrete, steel and brick. Tenders will be called shortly and it is anticipated that work will start this fall. Mr. G. W. Gouinlock, Temple Building, is the architect.

Tenders close November 3rd for supply of hardware for Davenport Road Police Station. Plans are at the office of the City Architect, City Hall, Toronto.

Tenders are desired by Mr. G. Morgan, 375 Palmerston Avenue, general contractor and carpenter, for one 2-ton hand power hoist in connection with $20,000 garage in course of erection on Bathurst Street and Vaughan Road for Mr. C. Coulter.

College Realty Compan-- 613 College Street, owners and general contractors, invite tenders for plastering a pair of stores and residences on Rushton and Benson Streets, estimated to cost $800,000. Buildings will be two storeys, 48 x 56, brick construction.

Roofers Supply Company, Shaw and Dupont Streets, have had plans prepared for construction of freight shed, estimated to cost $3,000.

Steel work has started on 7-storey Bank and Office building, corner Queen and Yonge Streets, for Imperial Bank, Wellington Street E. Harris & Harris, 110 Church Street, are the general contractors. Darling & Pearson, 2 Leader Lane, are the architects.

Plans are about ready in connection with new barns at jail farm, North Yonge Street. Work may be started at once by Board of Control.

Upton, Que.
Mr. E. Heta, of this town, announces that he will rebuild butter factory which was destroyed by fire, involving a loss estimated at $8,000. Insurance carried is reported about $3,000.

Vancouver, B.C.
Specifications are ready and tenders have been called for plumbing, heating, roofing, electric wiring and interior fittings on $20,000 office building, steel, mill and brick construction, for National Mercantile Company, 420 Winch Building. Mr. Glover Lloyd, 689 Roson Street, is the general contractor.

As soon as specifications are readv, tenders will probably be called for the contract to construct grain elevator for the Dominion Government Department Public Works. The structure is estimated to cost from $750,000 to $1,000,000 and to have a capacity of 1,500,000 bushels.

The factory of the Sunset Sash and Door Company, 724 Broadway W., which was destroyed by fire recently, will be rebuilt next spring. Estimated cost $10,000.

Waterloo, Ont.
The sub-contract for painting and building of $30,000 bank for the Canadian Bank of Commerce has been awarded to Fred G. Roberts & Company, Toronto. Dominion Realty Company, Toronto, are

the architects and Sutherland Construction Company, Ryrie Building, the general contractors.

Windsor, Ont.
The erection of a factory on Pitt Street W., for Mr. Alex Laforge, this city, is in contemplation.

The Windsor Lumber Company will be installing up-to-date machinery, driven by individual motors. Planing mill, for which excavation has been started, will be one-storey, 48 x 60, and will be erected on Cameron and Wyandotte. Mr. J. C. Scofield is manager.

Winnipeg, Man.
The City Council have obtained a loan of $2,000,000 to enable them to proceed with the Shoal Lake water scheme.

Plans are drawn by Mr. R. Crawford, 118 Sherbrook Street, for repairs to store recently destroyed by fire. Estimated cost $1,500.

CONTRACTS AWARDED

Niagara Falls, Ont.
The contract to supply concrete blocks for $8,000 garage here has been awarded to Mr. W. W. Palmer, River Road.

Ottawa, Ont.
The contract to build a garage on Gilmour Street for Mr. T. D. McFarlane, has been let to Taylor & Lackey, Ottawa.

St. Stephen, N.B.
The contract for construction of shoe factory at an estimated cost of $11,750 for the Town Council, has been awarded to Mr. Thomas Toal, Scovdiac.

Toronto ,Ont.
The general contract for construction of $17,000 club building at Sunnyside for the Parkdale Canoe Club, has been awarded to Mr. Geo. L. Robertson, 107 Armstrong Avenue. Building will comprise bathroom, 120 x 64, ball room 66 x 55, Georgia pine construction and trim.

Winnipeg, Man.
The contract for interior alterations to Manitoba Hall, 60 Portage Avenue, has been let to Mr. F. W. Gay, Winnipeg.

Residences

Arnprior, Ont.
Residence owned by Henry Hyland Tilrney Street, has been destroyed by fire

Bridgeburg, Ont.
Tenders will be received until October 30th for painting 2½-storey $4,000 residence in course of construction on Island Avenue for Mr. Russell Barton. The general contractor is Mr. Wilfrid Bernhart, Amigari, Ont.

Fergus, Ont.
The construction of a residence next spring is contemplated by Mr. Thos. Wilkie.

Guelph, Ont.
The construction of three brick residences is contemplated by Messrs. Peter Wilson, M. Kurpinski and Hugh Ferguson.

Grimsby, Ont.
Plans are drawn for the construction of a $4,000 residence [illegible] frame and brick construction. Mr. A. W. Eichmeier, Main Street, is owner and architect.

Hamilton, Ont.
Tenders for separate trades will be called and let as required in connection with construction of $8,000 residence on Main Street east, for Mr. Geo. A. Truman, K.C. G. Hudson, Driving Park Hotel, Barton Street East, is the general contractor.

Harriston, Ont.
Mr. C. L. Edy, Elora Street, has plans in progress for construction of a residence here.

Hull, Que.
A permit to construct $6,000 residence on Chelsea Road, two-storey, 20 x 40, has been issued to Mr. Wilfred Gravel, Chelsea Road.

The Co-operative Association of this city has in contemplation the construction of a number of residences on Aylmer Road next spring. A committee has been appointed to arrange for the purchase of material and letting of contracts. Mr. F. Foley, 38 Rideau Street, is the secretary.

Masonville, Ont. (London)
Tenders will be called shortly for heating, plumbing and electrical work on $4,000 residence, two storeys, 25½ x 46, solid brick construction, for R. G. Geary, Masonville P.O. The London Contracting Company, 401 Richmond Street, are the general contractors, and Mr. A. E. Nutter, London, is the architect.

Montreal, Que.
Tenders have not yet been called for construction of apartments on St. Catherine Street West, at an estimated cost of $35,000. Mr. James A. Godin, 269 St. Denis Street, is the owner, architect and general contractor.

Mount Brydges, Ont.
The owner and architect, Mr. Wm. Longfield, is having plans prepared for the erection of a white brick residence.

Plans are in progress by Mr. O. Munger, Front Street, owner and architect, for residence, white brick construction, stone and concrete foundation.

Ottawa, Ont.
Mr. Thomas Dean, 170 Cambridge Street, contemplates the erection on Breezehill of one $3,500 residence, brick veneer construction.

The erection of a 2½-storey brick veneer residence on Noel Street is contemplated by Mr. M. J. Cooper, 10 Oxford Street.

Oakland Land Company, care C. C. Ray & Company, Sparks Street, have the erection of a $4,500 residence in contemplation. Mr. J. M. Hurcomb, 1111 Bank Street, is the secretary.

Mr. H. Davy, 19 Ella Street, contemplates the erection of brick veneer residence on Findlay Street.

The erection of a number of residences on Booth Street, double brick veneer construction, is contemplated by Mr. J. Stacey, 678 Wellington Street.

Mr. F. C. Campbell, 245 Fifth Avenue, contemplates the construction of [illegible] on Clarey Avenue, at an estimated outlay of [illegible]

Queenston, Ont.
A site has been purchased for [illegible] to be erected by Frank [illegible]

Stratford, Ont.
Material for construction of two-storey [illegible] Wall Street, [illegible] by owner. The architect is Mr. [illegible]

Toronto, Ont.
Plans are in preparation for the erection of [illegible] detached residence on Mr. M. Chapman (in trust), 63 Strathcona Avenue, at an estimated cost of $12,000. Building will be 2 storeys, brick construction, and will be located on Wightman and Spadina Road.

Tenders are invited by Mr. Hyde, 115 Belhaven Road, on plumbing in connection with erection of $5,000 detached residence at 117 Belhaven Road. Other trades will be supervised by owner.

Tenders for plastering pair of residences on 112 Alton Avenue are invited by Mr. W. E. Tidy, 562 Ontario Street, owner. Building is 2½ storeys, 50 x 31, brick construction.

Mr. P. W. Coltman, 167 Robert Street, owner and general contractor, will let contracts for smaller trades in construction of $6,000 detached residence on Teddington Park Boulevard. Building is 2½ storeys, 23 x 42, brick construction.

• Tenders are still open for smaller trades in connection with 2½-storey, 28 x 32, brick residence, being erected by B. F. Carter, 15 Toronto Street, on North Boulevard, near St. Clair Avenue Mr. J. L. Hill, 154 Wheeler Avenue, is general contractor and architect.

Owner, Mr. G. Anderson, 511 Crawford Street, purchases all material and superintends construction of two-storey, 25 x 52, brick, detached residence, being erected on Bird & Elmwood Streets, at an estimated outlay of $4,000.

Tenders will be received by Elliott Brothers, 1310 Lansdowne Avenue, owners and general contractors, for all trades excepting masonry and carpentry, in connection with construction of two-storey, 20 x 30, brick, detached residence, on Tyrrel Avenue, at an estimated cost of $3,500.

In regard to construction of $4,000 detached residence on Bingham Avenue, the owner, Mr. C. E. Rook, 104 Scarboro Road, will sublet some of the smaller trades.

CONTRACTS AWARDED

Amherst, N.S.
The sub-contract for heating and plumbing $8,000 residence for [illegible] Victoria Street, has been awarded to Mr. James White, Victoria. The general contractor, Mr. W. A. Amherst, has all other trades. Building will be 2½-storey, 43 x 53, frame construction.

Power Plants, Electricity and Telephones

Dresden, Ont.
The Town Council is substituting hydro-electric lighting for the present system. Present station will also be utilized. Scheme will cost $9,500. Mr J. T. Bridgewater is the town clerk.

Fort William, Ont.
Electrical equipment will be required in connection with the construction of [illegible] front at an estimated cost of $25,000, for Consolidated Elevator Company. Mr S. J. McQueen, 23 Murray Block, is architect and general contractor. [illegible]

Kingston, Ont.
The City Clerk, Mr. W. W. Sands, [illegible] authorize the construction and maintenance of a telephone system. [illegible]

(Continued on page [illegible])

Tenders and For Sale Department

CAPITAL introduced for sound enterprises of all kinds. [illegible] commission. Bond and stock [illegible]. Underwriting procured. References [illegible]. Address Cooke & Byrne, Har[illegible] Street, Dublin, Ireland 40-45

Tenders for Hardware at Police Station, Davenport Road

[illegible] the above mentioned will be received by registered post only, addressed to the [illegible]

Tuesday, November 3rd, 1914

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering, as prescribed by City Bylaws, must be strictly complied with, or tenders may not be entertained. Tenderers shall submit with their tenders the names of two personal sureties, or the bond of a guarantee company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman of the Board of Control.
City Hall, Toronto, Oct. 20th, 1914. 43

Tenders for Foundation Work, Etc., at High Level Station

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on

Tuesday, November 10th, 1914

[illegible] Foundations in Engine and Boiler Rooms, and for the Laying of Trenches in Engine Room, at the High Level Station.

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering, as prescribed by City Bylaw, must be strictly complied with, or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or, in lieu thereof, the bond of a guarantee com- [illegible]

The lowest or any tender not necessarily accepted.

R. C. HOCKEN (Mayor),
Chairman Board of Control.
Toronto, Oct. 20th, 1914. 43

Laying Steel Intake Pipe
for
Board of Water Commissioners Port Hope

Tenders for excavating, dredging and laying about 1,800 ft. of steel pipe into Lake Ontario at Port Hope this fall will be received by the Secretary of the Board until 2 p.m. on November 16, 1914.

Plans and specifications may be seen on and after November 3, 1914.

R. GRAY, Esq.,
Secretary,
Board of Water Commission,
Port Hope, Ont.

F. W. THOROLD CO., LTD.,
Consulting Engineers,
43 2 Toronto St., Toronto.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 10th**, for the construction of the following sewers, viz. :—

Bingham Aven., Bracken Ave. to Lyall Ave.;

Drayton Ave., Danforth Ave. to south end;

Evans Ave., Colbeck St. to Annette St.;

Glebeholm Blvd., E. S. Greenwood Ave. to W. S. Bathgate Ave.;

Hillington Ave., Danforth Ave. to south end;

Kingswood Ave., Bracken Ave. to Kingston Road;

Lane 1st west Bloor St., Salem Ave. to Bartlett Ave.;

Main Gar. Cr. Storm Overflow Sewer, Section No. 5, through Bickford Park;

Milverton Blvd., E. S. Greenwood Ave. to W. S. Bathgate Ave.;

Oakdene Cres., Strathmore Blvd. to Glebeholm Blvd.;

Rosehill Ave., west limit lot No. 1, plan 920-K to east end;

Scarborough Road, Kingston Road to Gerrard St.;

Stacey St., 100-ft. west Hillington Ave. to 100-ft. east Drayton Ave.;

Wolverleigh Blvd., Linsmore Cres. to W. S. Bathgate Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council) or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by City Bylaw must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
Toronto, Oct. 21st, 1914. 43

Architects

An old-established firm of Patent Attorneys and Engineers are open for proposals from Architects in Toronto, Montreal, Quebec, Vancouver, Edmonton, Winnipeg, Fredericton and Halifax to act as representatives.. Write

Lloyd Blackmore & Co., Ltd.,
43 Ottawa, Ont.

To Architects

Architect with best New York and Toronto experience wishes accommodation in office of Toronto architect with good class practice, in return for part services or other arrangement. Has $15,000 public work going forward this spring.—Box 95, Contract Record, Toronto.

J. J. BECK,
43 245 Confederation Life.

Mechanical Superintendent

desires change. Has filled this position in connection with operations in England, Canada, India, Egypt and China. Capable of taking absolute control of mechanical end of any project. References on request. Box 87, Contract Record, Toronto. 42-44

Sales Agents Wanted

Large firm making electric centrifugal pumps, automatic electric compression water systems, electrically-driven multiple storage turbine pumps, and electrically-driven double acting pumps, wants sales agents in various parts of Canada. Representatives will be backed up with a liberal advertising campaign. Apply Box 86, Contract Record and Engineering Review, Toronto. 42-43

Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales agents for Canada. These transformers are for sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammetters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle.—Box 93, Contract Record, Toronto. 43-44-45

Late News Items

Duncan, B.C.

Tenders close November 3 for contract to build $40,000 court house for Provincial Government Department of Public Works. Plans are at office of Mr. J. Maitland Dougall, Duncan, B.C.; J. Mahoney, Court House, Vancouver, and at office of Department, Victoria. Messrs. Coates & Fleet, Winch Building, Victoria, are the architects.

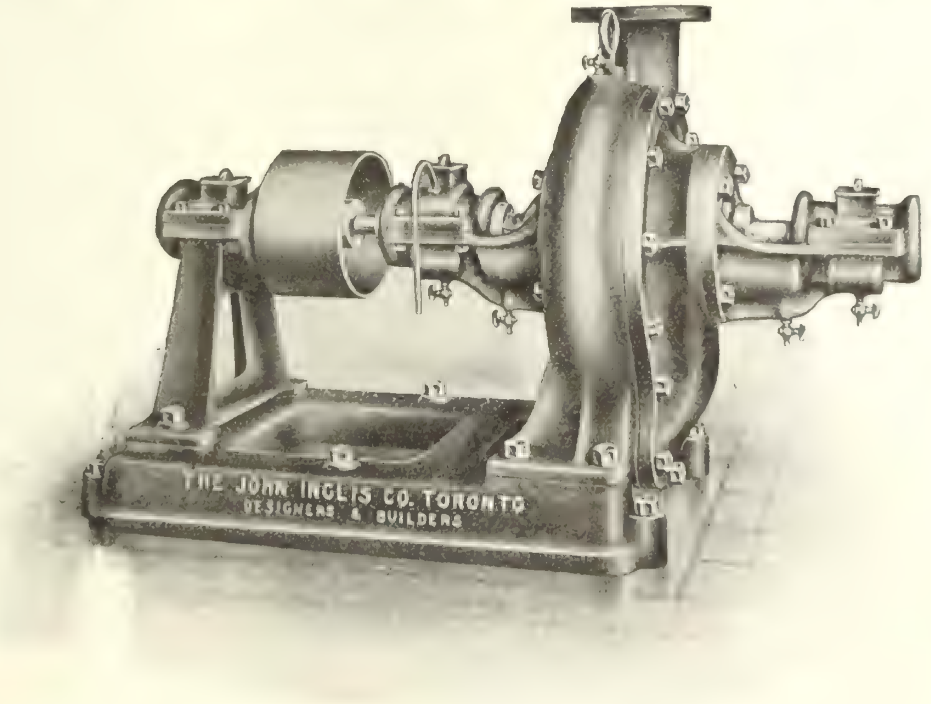
Galt, Ont.

The Baptist Church, Water Street South, will require seating and interior furnishings for $5,000 church in course of construction on Water Street North. Mr. John Girling, 50 Stone Road, is the architect and general contractor. Mr. Wm. Mogg, 42 Aberdeen Road, and Rev. F. D. Pink, 42 Stone Road, are the Building Committee.

Winnipeg, Man.

The Board of Control will receive tenders until October 30 for construction of water mains on Jesse Avenue and Dunfra Avenue. Mr. M. Peterson is the Secretary.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Power Plants, Electricity and Telephones

Continued from page 59

Newmarket, Ont.
[illegible] system, estimated to cost [illegible] is to be installed by the Town Council. Mr. P. K. Anderson is the Clerk.

Niagara Falls, Ont.
The City Council will use 100 c.p. nitrogen-filled tungsten lamps supported over iron columns, in connection with their River Road Electric Lighting scheme, providing for three miles of lighting. Iron standards and lights for street lighting decoration are to be purchased at an estimated cost of $125. Mr. F. J. Anderson is Engineer-in-charge.

An up-to-date garage equipment, also equipment for manufacturing carburetors (Electric power) will be installed by Williams & Company, 58 Parks Street, at whose address specification can be seen.

Ottawa, Ont.
The City Council will call for tenders in a few days for the supply of one 15,000,000-gallon electrically-driven pump for Limieux Island Low Level Pumping Station. It is stated that the contractor will be given eight weeks to deliver the pump.

Toronto, Ont.
The International Engineering Works, Limited, Toronto, have been awarded the contract to furnish four 250 h.p. Continental type Robb Scotch boilers, by the John ver Mehr Engineering Company, Toronto. The boilers are for installation at the Toronto filtration plant extension.

Wallaceburg, Ont.
The Town Council has decided to purchase lights and general equipment for all streets. Special lights for business section will be installed. Mr. H. E. Johnson is the town clerk.

York Twp., Ont.
The Township Council has decided to submit a by-law to the ratepayers regarding a proposal for the electric lighting of the township.

CONTRACTS AWARDED

Winnipeg, Man.
The contract to carry out alterations to incinerator plant in Ward 7 has been awarded by the Board of Control to Anderson Bros., Winnipeg.

Miscellaneous

Brandon Machine and Implement Works, 13th and Rosser Street, will be in the market shortly for one carload of pig iron.

The purchase of interior fittings for restaurant and candy store, including chairs, tables, show cases, soda fountain, etc., is contemplated by M. L. Fisher, Erie Avenue, Niagara Falls, Ont.

The general contract for construction of roaster for minerals, for Dominion Government Department Public Works, Ottawa, at estimated cost of $6,000, has been awarded to Taylor & Lackey. Structure will be steel and brick, concrete foundation.

Max Schacknove, builder, Hamilton, has assigned to W. G. E. Boyd.

The contract for installing coal-handling apparatus at main pumping station, Toronto, has been awarded to Phillips, Lang & Company, Chicago, Ill., at $22,800.

E. Gross & Company, painting and glazing contractors, Montreal, have been registered.

International Pilaster Board Company has been registered at Montreal.

The Premier Glass Company of Canada, Limited, has been registered at Montreal.

Sanriol & Cie, contractors, Montreal, have dissolved.

The Town Council have awarded the the following contracts in connection with their street lighting scheme:—William Hamilton & Company, Peterboro', Ont., supply of standards, etc.; G. M. Gest, Montreal, conduits; Eugene Phillips Electrical Works, Limited, cable and wire.

New Companies

The Beaver Wood Fibre Company, Limited, has been incorporated with head office at Thorold, Ont., and capital of $1,000,000. The new company will take over the business of the Beaver Company, Limited, to manufacture roofing and building materials, paper and wood pulp.

Campbellton Development, Limited, has been incorporated with a capital stock of $45,000 as a building company. The head office is at Campbellton, N.B. Mr. Patrick Loubert, builder, Campbellton, is one of the incorporators.

HOISTING ENGINES

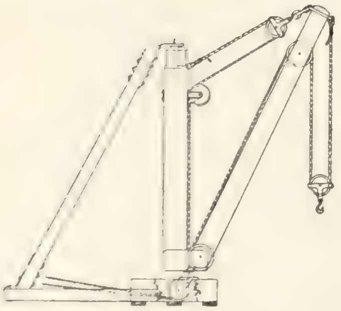
DERRICKS

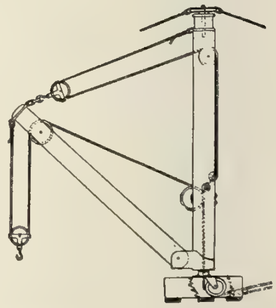
HORSEPOWERS WINCHES OR CRABS

Standard sizes and capacity of derricks in stock for immediate shipment.

Get our prices—they will interest you.
All goods guaranteed.

MARSH and HENTHORN, LIMITED, Belleville, Ont.
Designers and Builders of Hoisting Machinery
Sales Agents: MUSSENS, LIMITED, Montreal, Que.





Tenders

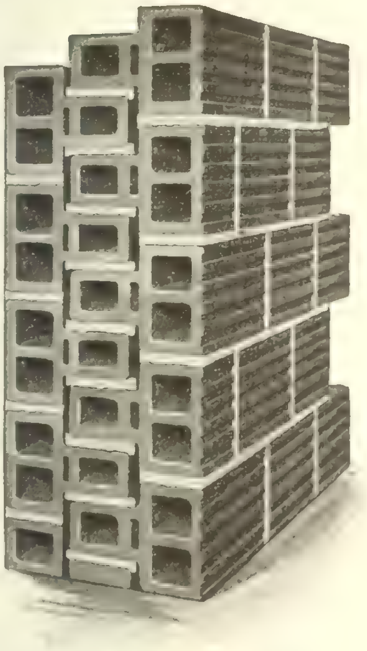
A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

DENISON

Interlocking Hollow Tile



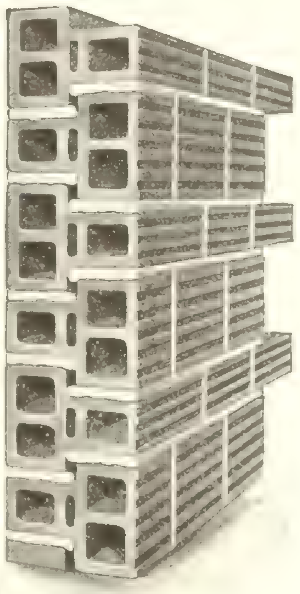
Twelve Inch Wall

The one size and shape builds all thicknesses of walls.

Denison Interlocking Hollow Tile, the modern building material, possesses bonding and interlocking properties unequalled by any other tile.

When Denison Tile is used in wall construction, there are no mortar joints extending through the wall to carry moisture. This feature, together with many dead air spaces, renders the Denison Tile wall impervious to moisture, heat, cold and sound.

Denison Hollow Tile is fireproof.



Eight Inch Wall

Orphanage for I.O.O.F. BUILT LIKE A THERMOS BOTTLE Oakville, Ont.

Architect: Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.

SUN BRICK COMPANY, LIMITED

The One Price Company

Traders Bank Building TORONTO, ONTARIO

Current Prices of Building and Engineering Materials

General Review of Market Conditions

GENERALLY speaking there is not much [illegible] to report regarding structural [illegible] in the principal centres of On[illegible] the past month. Building work on [illegible] which has been in operation for some considerable time, is being carried through to completion very much as usual. This [illegible] work is perhaps more numerous in To[illegible] part of the province. In residences, however, there is little actual construction work being carried out at the present moment, owing largely to the diminution in [illegible]. Manufacturers of building materials report a fair volume of business. The [illegible] which residential building has received is no doubt responsible to some extent for the necessary curtailment in the output of brick. Owing to the action of the banks and loan companies with regard to loans many of the smaller contractors are unable to finance operations. The prevailing opinion is that if sufficient money was available at reasonable rates business in the building field would take on a new lease of life. Speaking on this subject a prominent brick manufacturer declared that business would proceed as usual if the banks and loan companies would finance speculative building. Municipal work has undergone some curtailment of late, [illegible] this respect being confined almost exclusively to necessary works. Regarding market conditions, moderate business is reported in most quarters. Brick is much cheaper at present than it has been for some considerable time, one explanation of this being the increasing size of stocks. There are no changes in cement and [illegible] of which remain firm, and Toronto dealers report satisfactory business considering present conditions. Steel and iron also have undergone little fluctuation in price and the demand is reported to be fair. Paints and oils have decreased in price since last report, notwithstanding which the volume of business is said by prominent dealers to be somewhat better than it was at corresponding date last year.

At Montreal the situation has not undergone any material change as compared with a month ago. So far as building is concerned, the permits continue to show a considerable falling off, the bulk of the permits being for residences. As the season draws to a close, the demand for supplies naturally tends to decrease, but some of the firms report that taking all the circumstances into consideration, business may be regarded as satisfactory. The most encouraging feature is the demand from country buyers; the harvest has been good, prices obtained for products are high, and there is a decided inclination to keep trade on the usual level. One Montreal contractor who employs a force of about 200 people, has decided to go on building residences throughout the winter. Brick is in moderate request, while there is a steady call for lime, crushed stone, sand, gravel, and sewer pipe. The curtailment of the demand for cement continues but trade is sufficiently good to warrant the declara[illegible] quarterly dividend of 1 ¼ per cent. by the directors of the Canada Cement Company. Buying of the various commodities referred to is not so large as compared with the corresponding period last year, but it is not as slow as some of the pessimists would give one to understand. There is in fact a gradual return of confidence, and, in the event of continued good news from Europe, there is likely to be an excellent beginning next season. There is little doing in iron and steel. The lumber trade too, is not brisk, although there are indications that next season will be one of the best in the history of the industry. Owing to the lowering of prices in the United States, Canadian manufacturers of rope have been obliged to follow suit, and quotations are down right along the line. The linseed oil market is another weak spot, and in consequence of the poor demand, particularly from the Old Country, prices have been reduced.

At Winnipeg, conditions while not nearly as good as was expected, cannot be said to be bad, considering the season of the year. Constructional work is proceeding on many large blocks, while the Government has voted a further $2,000,000 to complete the parliament buildings. According to the various supply houses, a decided improvement which they expected this last month, has not materialized, owing to the tightness of the banks and loan companies regarding loans. Many contractors are unable to finance work for this reason, and it is certain that if the banks and loan companies would furnish the loans, trade would considerably brighten generally. There are a few large contracts closed owing to this tightness of money at the present time, and these would be proceeded with were the banks and loan companies less stringent. Civic work has been curtailed, only work which is absolutely necessary being carried out. Private enterprise remains rather inactive, although there are a few contracts being carried out. It cannot be expected that there will be any great increase in work of this kind owing to the lateness of the season. Taking everything into consideration, it is only to be expected that the demand for building and engineering materials will fall below the average this year. The outlook for the future, although enshrouded in uncertainty, is not nearly so black as many people would have us believe. The government is to continue work on all the public buildings now under construction until such a time as the weather turns too severe. The importance of this announcement cannot be overestimated, for while the various supply houses will benefit considerably, it will also give work for many men for a few months to come. A pleasing feature of the situation is the value on the farm of this year's crop, which is estimated by a prominent financial statistician to be $236,500,000. As soon as the money from this source is circulated, there may be a corresponding increase in trade and the situation generally will assume a more prosperous air. Throughout the city, the merchants are possessed with a quiet confidence which seems to point to better times coming soon.

Regarding market conditions, there is a feeling of confidence that trade will improve. There is little change in cement, lime and brick since our last report, the demand being extremely quiet. However there has been a slight revival in crushed stone, sand and gravel, and future developments seem to show signs of a continued improvement. It is expected that prices for these materials will hold firm. There is little or no change to report in the lumber trade. Prices remain firm. Collections however, are loosening up. One large supply house stated that there was a certain amount of credit business to be done, but this was not acceptable at the present time, owing to the state of the financial market. The market for steel and iron products is very quiet, with a tendency to improve. Prices remain as hitherto quoted, except in the case of cast iron water pipe, which is now quoted at $38 per ton, car load lots, f.o.b. Winnipeg. Business is dull in the sewer pipe business, no new business is expected until the spring. Prices remain unchanged. Business is very brisk in the paint and oil line, in fact one large firm reported that the sales this year only fall short of those of last year by a few hundred dollars, and that there is every likelihood that there will continue to be brisk demand for these products. Prices have been subject to a slight revision, a slightly higher rate being quoted. A special feature is the large quantity of putty being sold, together with a drop in the price quoted for turpentine in barrels, which is now quoted at 75 cents per gal. as compared to last month's quotation of 85 cents.

At Vancouver the conditions prevailing at last report show no appreciable change. The policy of retrenchment in constructional works adopted by municipal bodies in various parts of the Province has limited the volume of building activity. Pending the arrival of brighter conditions it is anticipated that little work other than what may be considered absolutely necessary will be embarked on for some time. In view of these considerations it is in no wise surprising that dealers in builders' supplies and manufacturers of building materials should be inclined to a policy of doing their best quietly to maintain stable conditions with a view to improved business in the spring.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; tapestry brick, $20 to $30; sand-lime brick, $7.60; King Edward Siding; $6.50 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over y00,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$3.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 57c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 67c, per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

(Continued on page 68)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks:
SYDNEY, N. S.
MONTREAL, QUE.
TORONTO, ONT.
FT. WILLIAM, ONT.

Sales Offices:
SYDNEY, N. S.
MONTREAL
112 St. James St.
TORONTO
18 Wellington St., E.

Mills and General Offices:
SYDNEY, N. S.

WIRE NAILS and other **WIRE PRODUCTS**

KENNEDY
Balanced Jaw Crushers

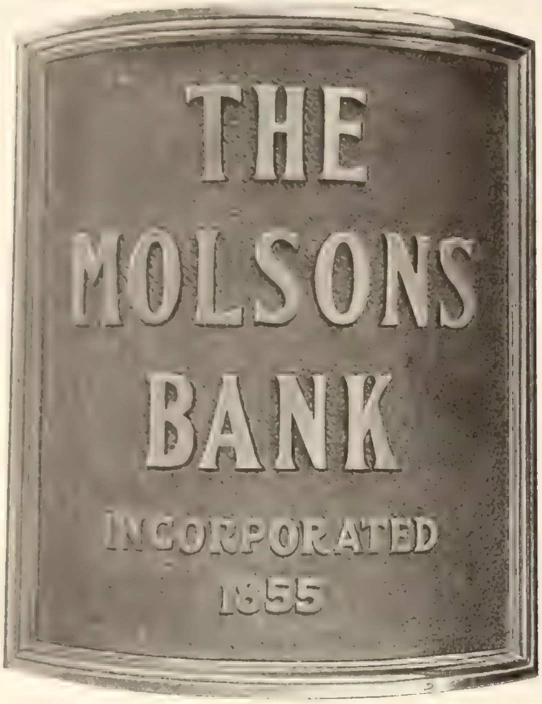
made in sizes with
openings from
10" x 7" to 96" x 60"

Interchangeable and Reversible
Jaw Plates

Rock & Power Machinery, Limited

HEAD OFFICE: 12 King Street East, TORONTO

BRANCH OFFICES: Vancouver, Halifax, Cobalt, Montreal, Sudbury, and in the King Edward Hotel, Toronto



DENNIS-LONDON ORNAMENTAL IRON

SIGNS

Brass and Bronze

The next time you are in the market for signs of this class give us a chance to quote you. We are turning out some exceptionally high-class work in this line and would be glad to figure with you whether your order is large or small.

THE DENNIS WIRE AND IRON
WORKS CO. LIMITED
LONDON
CANADA

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

QUOTATIONS FURNISHED.

The GEO. B. MEADOWS

Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

"Hammer Brand"

Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.

Hillsborough, New Brunswick, Canada

Canada Wire & Cable Co., Limited
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Bare and Insulated Electrical Wires for all purposes.
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Sales Offices and Branch Warehouses:
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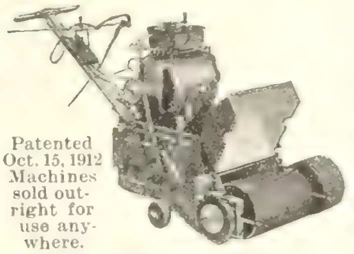
Prompt shipments from Factory or nearest warehouse.

THE AUTOMATIC BALL BEARING ELECTRIC FLOOR SURFACING MACHINE

Contractors and builders find, dresses in paying quantities, quarter-sawed oak, maple, etc., the way they want it or rapidly refinishes old floors. Having ballbearings, roller and dust-suction fans spin true and easy: yielding arms give flexible or rigid roller as needed; self-propelling with automatic control gauges roller cut for even work and brakes forward pull for large capacity—you simply guide. Surfaces to base baseboard with Edge Roller. No hand scraping.
Booklet tells all about it and our



Patented Oct. 15, 1912
Machines sold outright for use anywhere.

FREE TRIAL OFFER
Made in several sizes for small rooms or large areas. Let us send you the names and addresses of Canadian owners near you.

Wayvell Chappell & Co.
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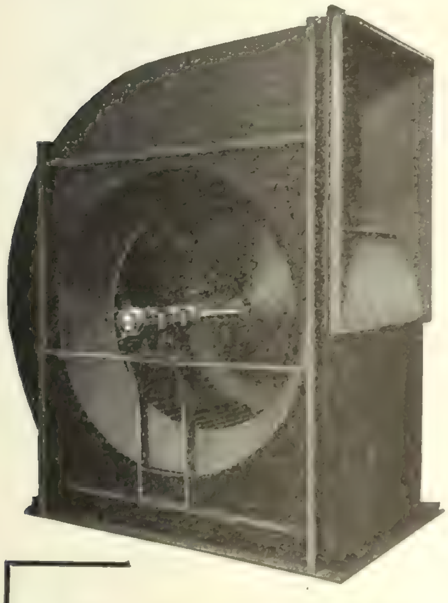

Greatest in Capacity and Efficiency

Genuine "Sirocco" Patented
TRADE MARK.

Multi-Blade Fans and Blowers
—MADE IN CANADA—

Exhaustive tests conducted by our Experimental Department and by competent, unprejudiced engineers in competitive trials, has proven conclusively the "Sirocco" to be the most efficient commercial fan in the world. It occupies less space, and requires considerably less expenditure of power for a given duty than any other type of fan. Proper design and construction are the basis of the superiority of the "Sirocco" Fan, and make it the ultimate standard of excellence everywhere.

Learn concerning its principle of construction and why it is the best.

Single Inlet, Top Horizontal Discharge Sirocco Fans Built in sizes with capacities of 75 C.F.M. to 1,000,000 C.F.M. in all angles of discharge and arranged for either pulley, motor, engine or turbine drive.

"Sirocco" Catalogue No. 201, valuable to Engineers, Architects and Contractors.

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DUMBWAITERS

For simplicity, durability and quick service Chelsea Dumbwaiters are without a rival.

Catalogue and prices will be supplied by our Canadian Agents
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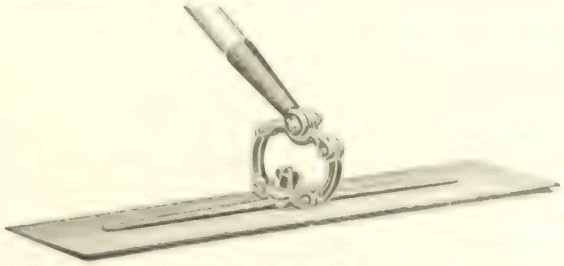

"Abram" Sidewalk Finishing Tools [illegible] Guarantee that ONE MAN [illegible] THREE MEN [illegible] the wages of TWO MEN [illegible] "Abram" Tool. [illegible]

ABRAM CEMENT TOOL CO. 105 Ouellette Ave.
WINDSOR, ONT.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 64,

Brick—No. 1 pressed, $17; No. 2 pressed, $15; [illegible] rustic, $20, buff rustic, $20; red [illegible], $14; buff (smooth), $21; buff (rough), $25, plastic, $8.50, C. P. R. 50c extra except on plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals). Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2 in., $1.40; ¾ in., $1.65; ⅜-in., $1 75, per ton, delivered.
Sand—95c per ton, car loads, on cars.
Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82, 24 ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 57c per gal. of 9 lbs. Raw linseed oil—in barrels, [illegible]

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.
Lime—Grey, 34 cents per bushel; white, 32 cents.
Brick—[illegible] pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾ in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.
Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.
Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.
Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.
Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.
Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:
Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

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Pulp and Paper Mills
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We also build

Steel Structures

to support them.

Write us for quotations

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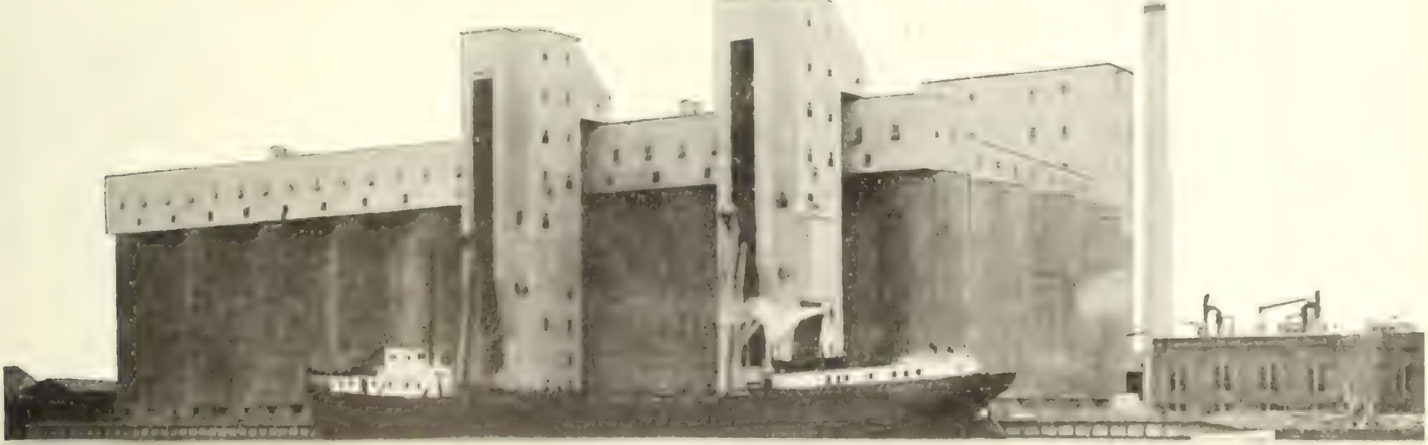
SHERBROOKE, QUE.



built with Burlington Steel Bars

For the [illegible] Ont., two [illegible] walls. The engineers were John S. Metcalf Co., Ltd., Montreal, to whom we are indebted for the above photograph of the elevator. Scores of other prominent engineers throughout Canada [illegible] Burlington Steel Bars.

Rounds, Squares, Flats, Twisted Squares, Angles, Channels, T-Bars, Ovals, Half Ovals, Half Rounds, Bands and Special Sections; Cross Arm Braces; Pole Shims

Prompt Shipment from Stock

[illegible] worthy contracts for which Burlington Steel Bars have been used:

Wardell Falls Dam [illegible] of Ontario.

Elevators No. 1 and No. 2, Montreal— [illegible] Harbor Commissioners.

Maple Leaf Milling Co. J. H. Tromanhauser Co., Limited.

Grand Trunk Pacific Elevator at Fort William, Ont.

Canadian Westinghouse Co. Addition to Hamilton Plant.

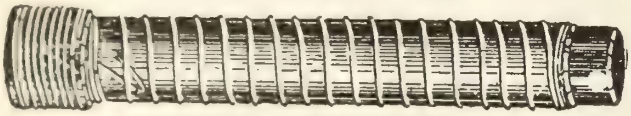
Section 2, Welland Canal [illegible]

BURLINGTON STEEL COMPANY, LIMITED, HAMILTON
FORMERLY "CANADA STEEL COMPANY, LIMITED"

RIVETED TANKS
RIVETED PIPES
PONTOONS
and other similar works

Manufactured by

Canadian Stewart Co., Limited
TORONTO



Continuous and Machine Banded Wood Stave

WATER PIPE

Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
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Write for Catalogue
Full Particulars and Estimates Furnished

HARBOUR
Sand-Lime Brick

MADE from clean, pure silica sand and the highest grade calcium lime by the most up-to-date equipment. The result is a brick from outside to core, uniform in density, strength and size.

Ask for further particulars—results of University crushing tests.

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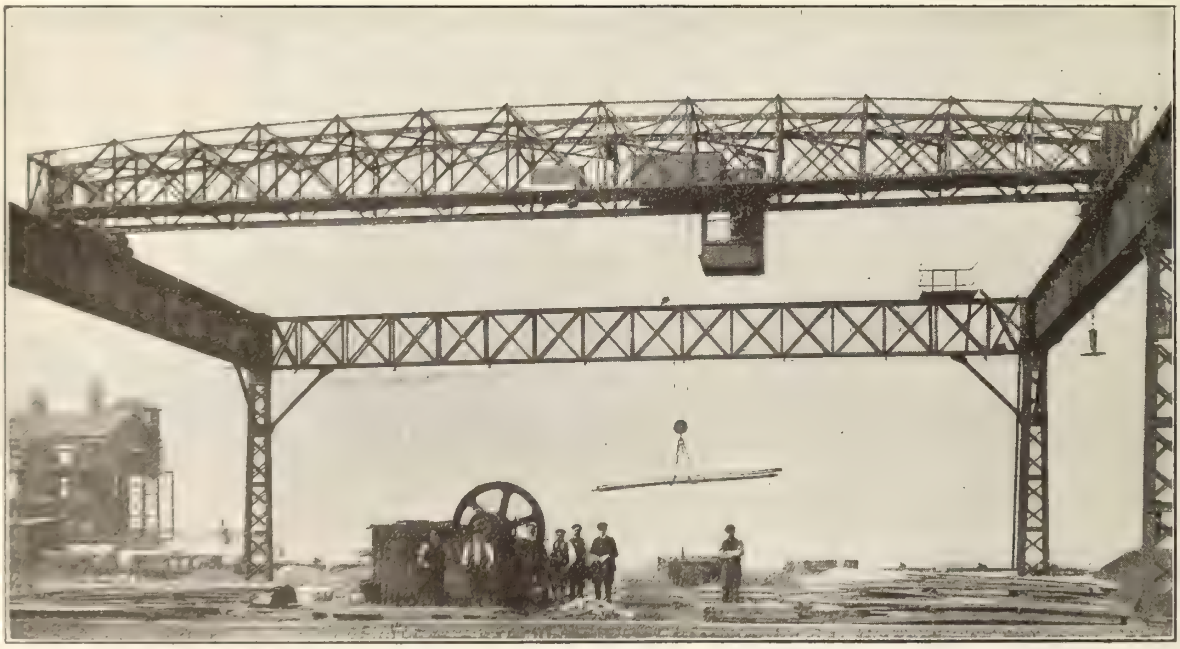

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Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

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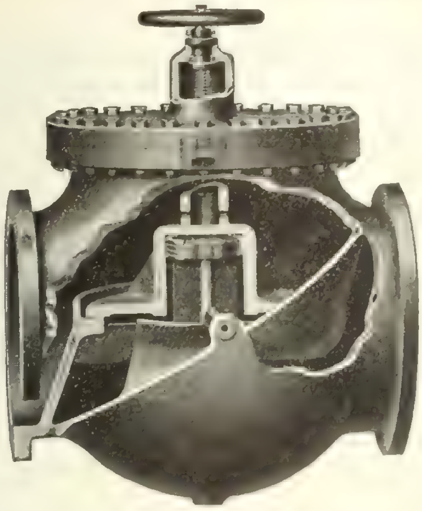

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We make automatic exhaust relief valves of all sizes and types—horizontal, vertical, angle and downward discharge. An inside dashpot of ample size eliminates shock in closing and a water seal insures the valve against leakage.

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Galvanized or Copper Cornices, Skylights, Steel Shingles, Steel Ceilings and Walls, Ventilators, Steel Siding, Corrugated Iron, "Hayes" Patent Steel Lath, etc.

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Towers and Tanks for all purposes.

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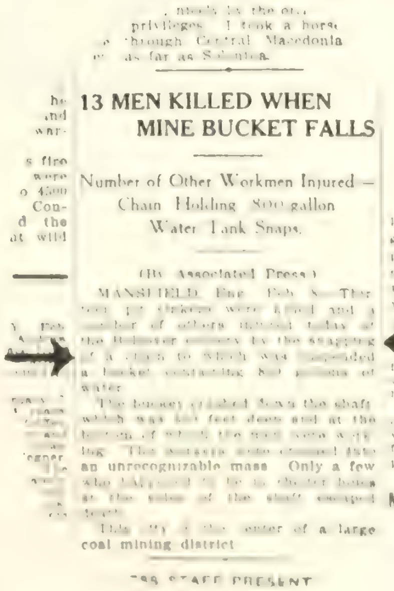

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Number of Other Workmen Injured — Chain Holding 800 gallon Water Tank Snaps.

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Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

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The Electric Steel & Metals Co., Ltd.
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Many a mistaken-head doesn't buy from Aikenhead.

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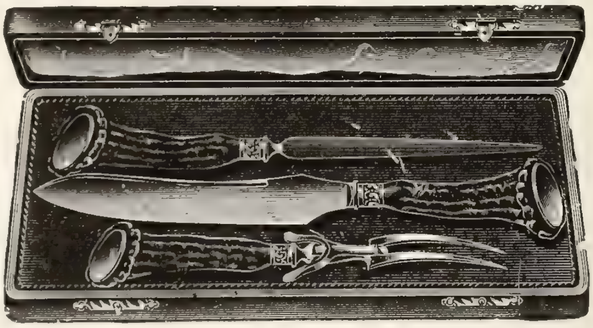
Hardware sold by Aikenhead in Quality has always lead.

SHEFFIELD CUTLERY

A $1.50 Sheffield Razor Absolutely Guaranteed.
AUTO-STROP SAFETY RAZOR
500 Shaves Guaranteed from 12 Blades, $5.00.

Nickle-Plated Steel Dinner Knives, very keen Edge, no Polishing $6.00 doz.



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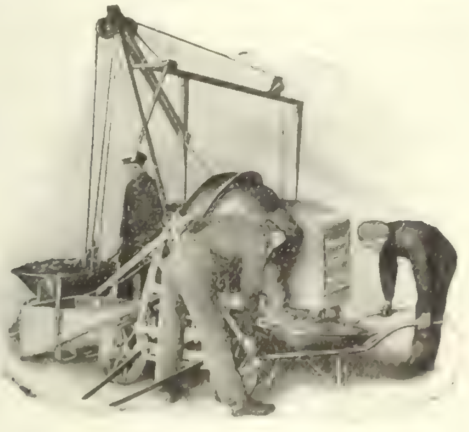
just the Mixer you've been wishing for
The "Big-an-Little"



1914 Model now ready

The small mixer has proved its worth. You know it pays better to have one or more small portable mixers than to mix by hand or to have a great big clumsy mixer. The question has been to get a Dependable Small mixer at a low price.

The "Big an Little" is the biggest and best small mixer on Earth, and our Low Prices amaze the Mixer World. They are used everywhere. Write us NOW.

The Jaeger Machine Co.
Columbus, Ohio

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Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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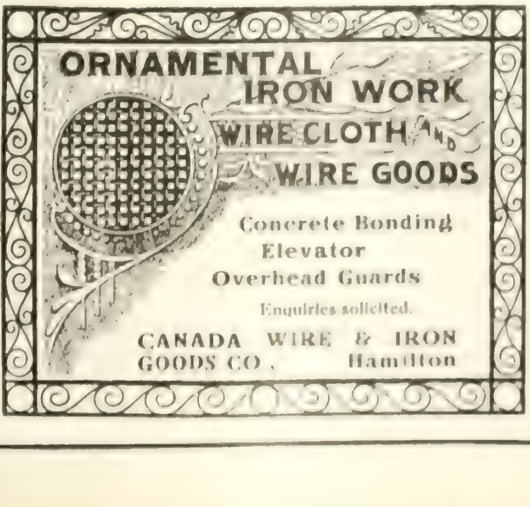

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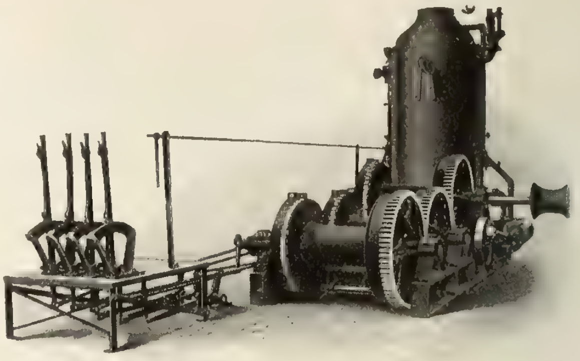

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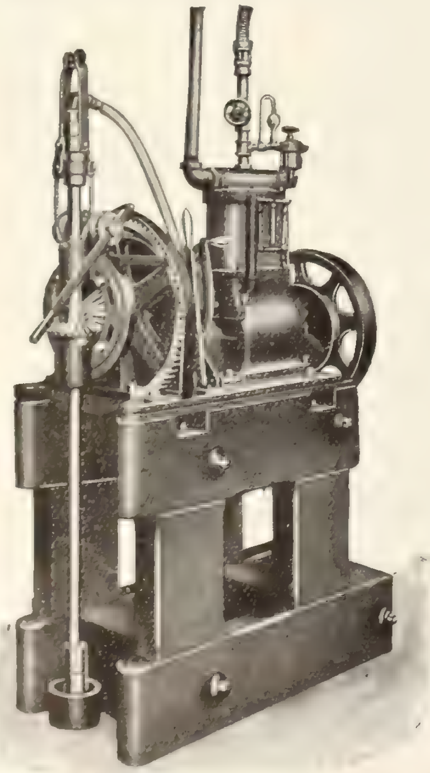

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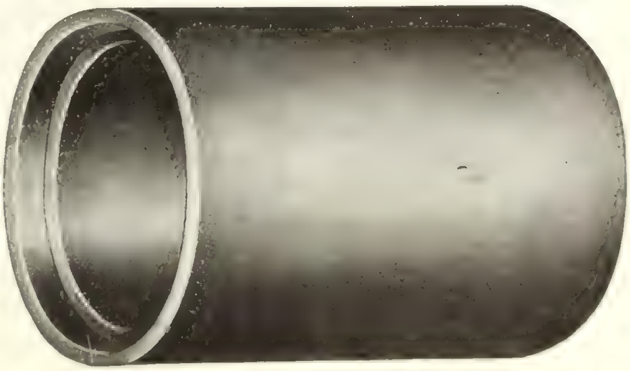

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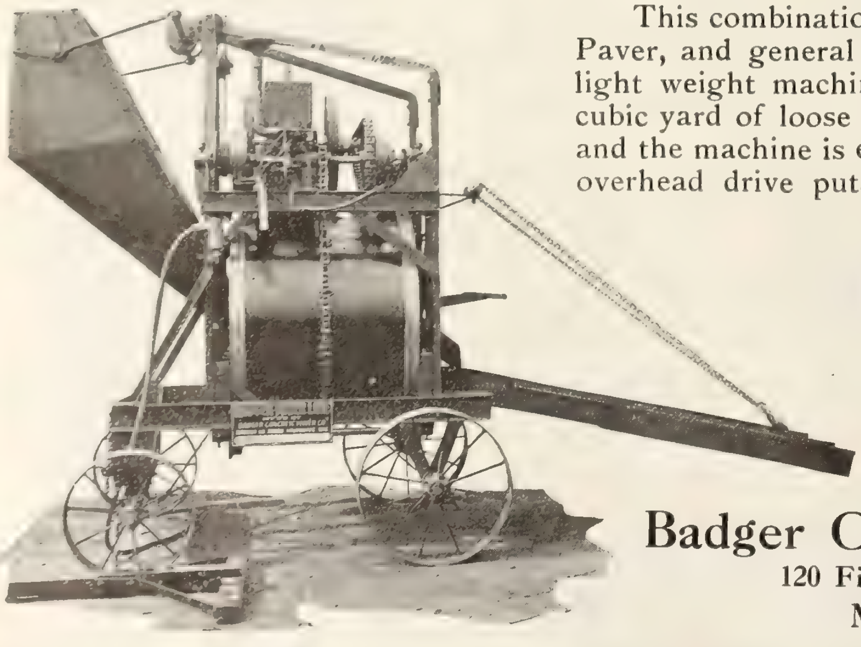

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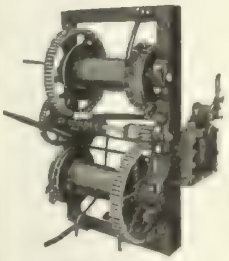
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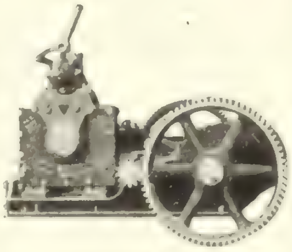
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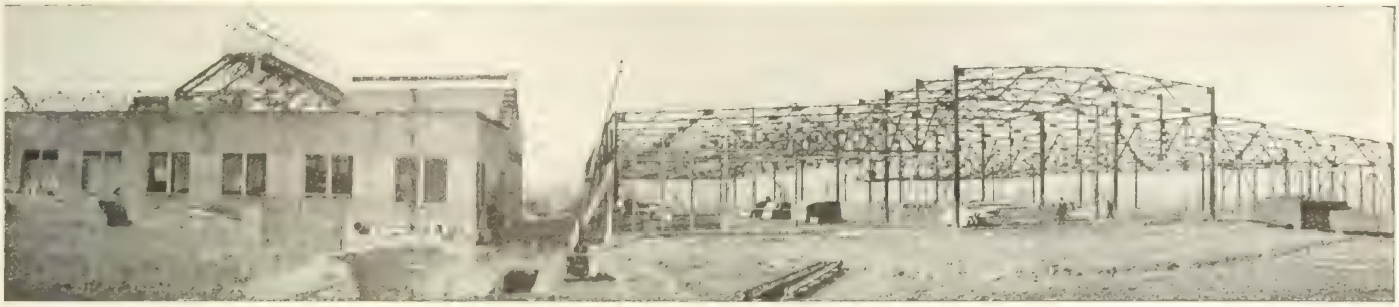

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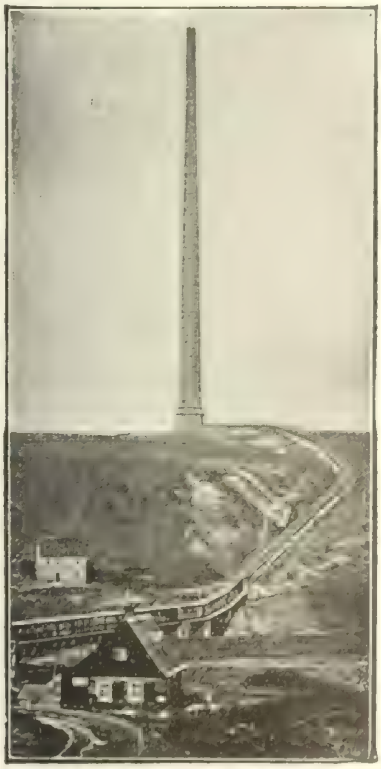

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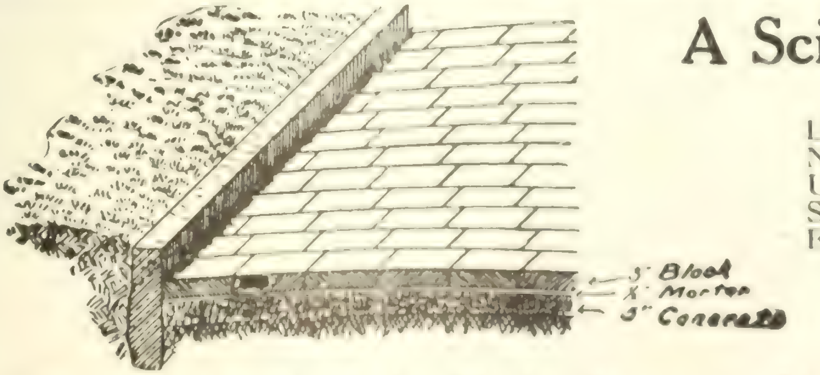

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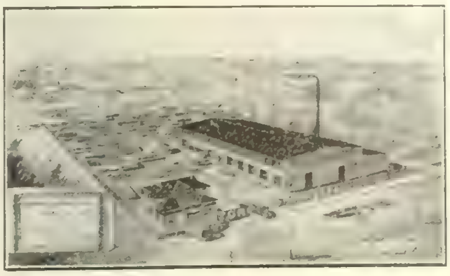

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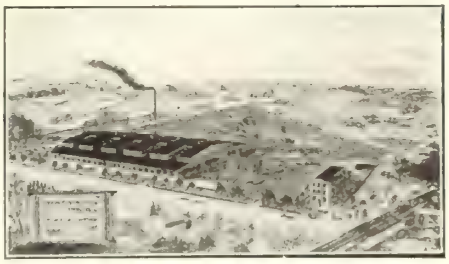

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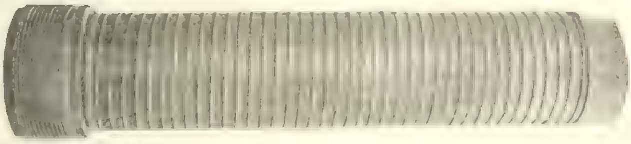

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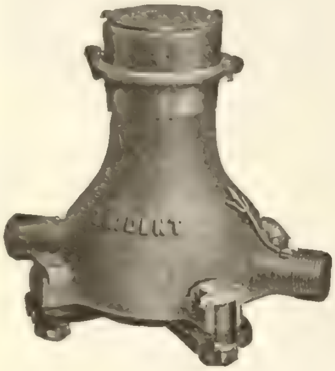

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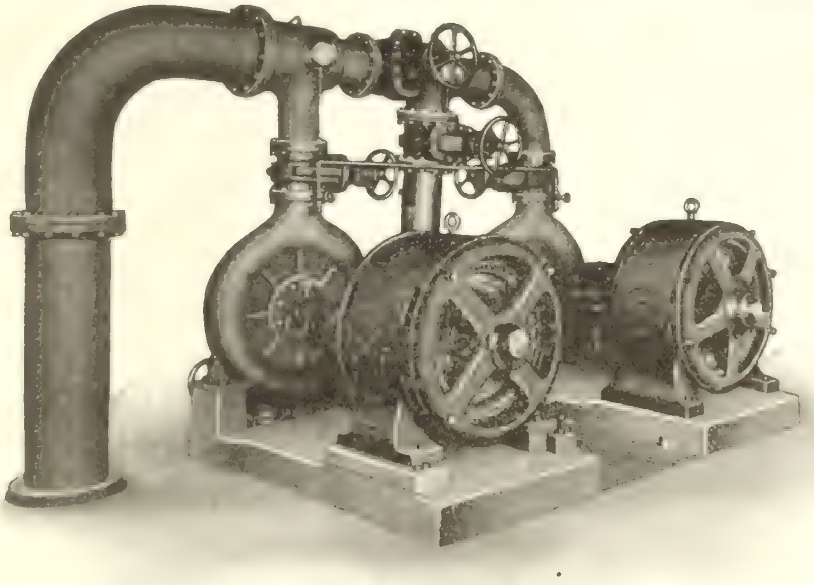

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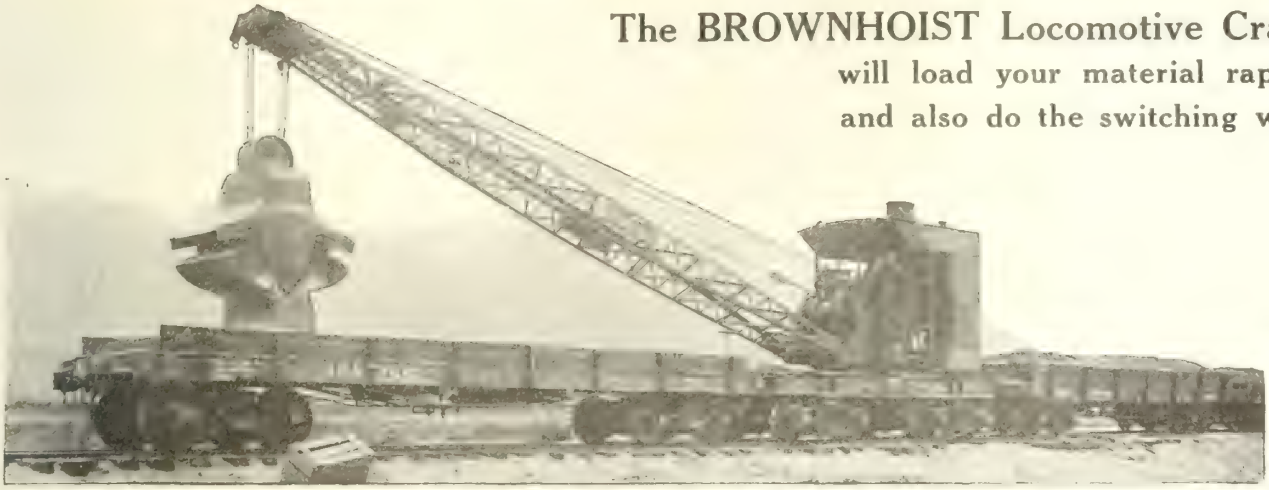

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Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

Buffalo Single Cylinder Double Acting Power Pump

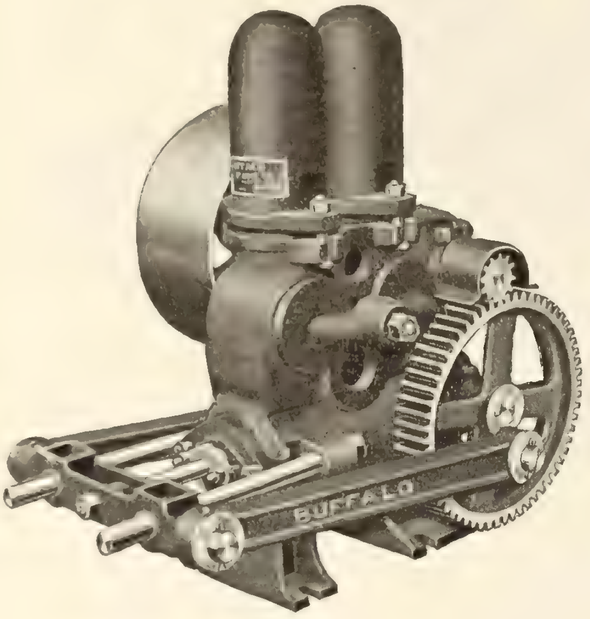


Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

Metal to metal ground joint between head carrying crankshaft bearing and the main cylinder casting, giving absolutely accurate alignment.

Pump cylinders are brasslined, valves, valve seats and gland are brass; piston rods are brass fitted.

All bearings are lined with high grade babbitt and provided with large grease pockets with hinged covers.

Suction and discharge openings are provided on both sides of the pump.

Built in sizes 10 to 100 gallons per minute.

Send for Circular No. 255-C12.

Buffalo Steam Pump Co.
Buffalo, N. Y.

—Sole Canadian Agents—
Canadian Buffalo Forge Co., Limited
Berlin, Ontario
St. John, Montreal, Toronto, Winnipeg, Vancouver

There are no smokestacks in Garden City, New York. The community is too carefully restricted for that. Gothic Cathedrals, fine residences and stately trees predominate and disfiguring chimneys are banned.

Sturtevant
(REG. CAN. PAT. OFF.)

Mechanical Draft

enables you to build where there is opposition to tall chimneys. But that's just an incidental advantage of our mechanical draft systems.

The big advantage is that you can get more steam from your boilers. You can get the same power with cheaper grades of coal. If a sudden peak comes you can speed up the fan and carry the additional load with ease. If used in connection with Sturtevant Fuel Economizers savings as great as 20% can be secured.

We haven't space to prove it here, but we have all the facts. Get in touch NOW.

B. F. Sturtevant Company
of Canada, Limited
GALT, ONTARIO
Montreal Toronto Winnipeg Vancouver

From generator to consumer you should install reliable

Northern Electric Wires and Cables

In the largest wire plant in Canada—under the Northern Electric trade mark and guarantee is manufactured *every type* of wire and cable, including

High Tension, Lead Covered Paper Insulated, Power Cables

Northern Electric Wires and Cables are the most carefully made—the most rigidly tested—the most universally satisfactory transmission in use to-day. From raw material to finished product the skilled workmanship of our operatives is ***continuously*** supervised and inspected. Electrical engineers whose reputations have been made on exacting work of great magnitude, use Northern Electric Wires and Cables.

One order recently received from the Montreal Light, Heat and Power Company and another from the Cedars Rapids Manufacturing & Power Company together constitutes the largest single order ever placed for lead covered high tension power cable. The first mentioned concern has more underground cable installed than any other public service corporation — and its Engineers ***know*** Northern Electric dependability from comparative tests ***in service.***

The Northern Electric line includes:

Cable Terminals,
Compounds, Junction
Boxes and other accessories

Write for data on any wire or cable problems that confront you.

Northern Electric Company
LIMITED

MONTREAL
HALIFAX
TORONTO

WINNIPEG
REGINA
CALGARY

EDMONTON
VANCOUVER
VICTORIA

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

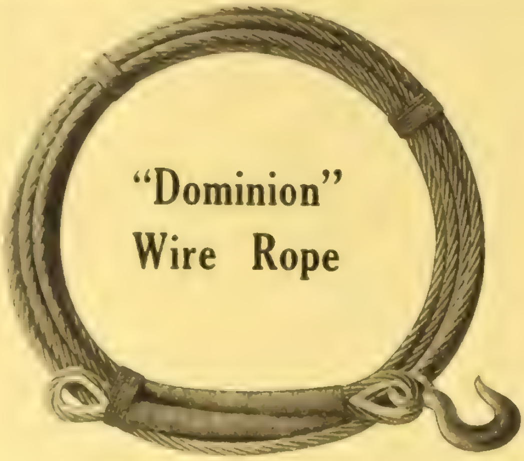
This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West. Toronto
Phone Adelaide 2700



WIRE ROPE

Suitable for any requirement

We carry in stock all sizes and lengths of wire rope for Hoisting, Haulage, Guys, Semaphores, Transmission of Power, Towing, Bridges, Mines, Derricks, Cranes, Cableways, Coal Towers, Etc.

We manufacture special ropes to take care of your particular needs.

Wire Rope Fittings, Blocks, Clips, Etc., in stock

THE DOMINION WIRE ROPE CO., Ltd.
MONTREAL

"Industrial Works"

Locomotive-Coaling and Wrecking

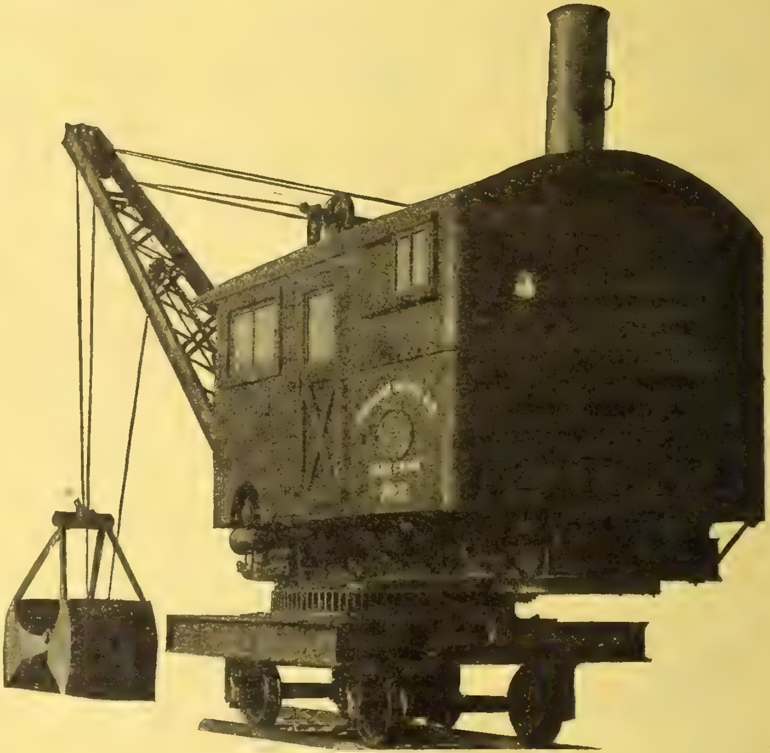
CRANES

In capacities from
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request.

We supply Contractors' Equipment of all descriptions.

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, November 4, 1914 No. 44

ESTABLISHED 1886

Contract Record and Engineering Review

BELLISS & MORCOM, LTD.

Engines and Air Compressors

Over 150 Sets Installed in Canada

Laurie & Lamb
Sole Agents for Canada for

R. HORNSBY & SONS
Gas and Oil Engines

PATERSON ENGINEERING CO.
Municipal Filtration Plants

J. P. HALL & SONS
Boiler Feed Pumps

AVELING & PORTER
Steam Road Rollers

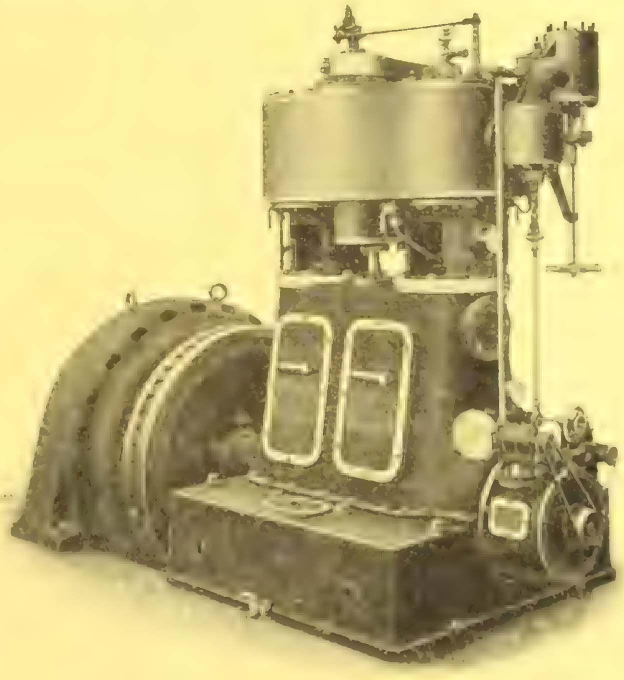
JONES & ATTWOOD
Sewage Installations

LEYLAND ENGINEERING CO.
Motor Trucks and Fire Appliances

W. SMITH & SONS
Road Sweepers

S. H. JOHNSON & CO.
Filter Presses
"FRAM" Electric Wagons

HEENAN & FROUDE
Refuse Destructors



570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

Here is a Genuine "CROSBY" CLIP

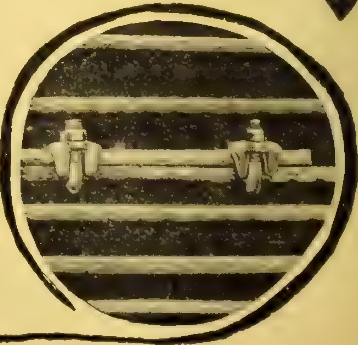
The Genuine Crosby Clip is the Ideal Reinforcement Bar Connection

Part of the Steel work of the Duluth Reservoir

It has made possible such efficient yet economical reservoirs as those constructed by the city of Duluth, Minn., the state of Illinois at Anna, Ill., and by the Anheuser-Busch Brewing Co., at St. Louis, Mo. Full particulars on request.

The "CROSBY" Clip is drop forged from a special grade of steel—galvanized to prevent rust. It has tremendous gripping power. Once tightened, it will not pull out, break out, nor rust out.

Here is how the "CROSBY" Clip is used to connect reinforcement bars



Manufactured By

AMERICAN HOIST & DERRICK CO.

St. Paul, Minn., U. S. A.

Sold By: General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

28 "Service" Branches
Throughout Canada

Canadian Consolidated Rubber Company, Limited

Montreal, P. Q.

"Business As Usual"

We have not, owing to the war, shut down any of our plants, discharged any of our workmen, reduced their hours of labor or cut their rate of pay.

We are doing "BUSINESS AS USUAL."

We intend to continue this policy to the extent of our ability, and, to that end, suggest that you confine your purchases, during the war and thereafter as largely as possible to goods "MADE IN CANADA."

When in the market for Rubber goods of any description—Belting, Hose, Packing, Tires or anything else—write or wire our nearest Branch for prices and information.

It is our desire to serve you.

"Business As Usual"

Canadian Consolidated Rubber Company, Limited

Montreal, P. Q.

28 "Service" Branches
Throughout Canada

Anywhere and Everywhere

Hayward Orange Peel Bucket

That there is digging, excavating or rehandling of any kind to be done, there is the greatest possible economy in using

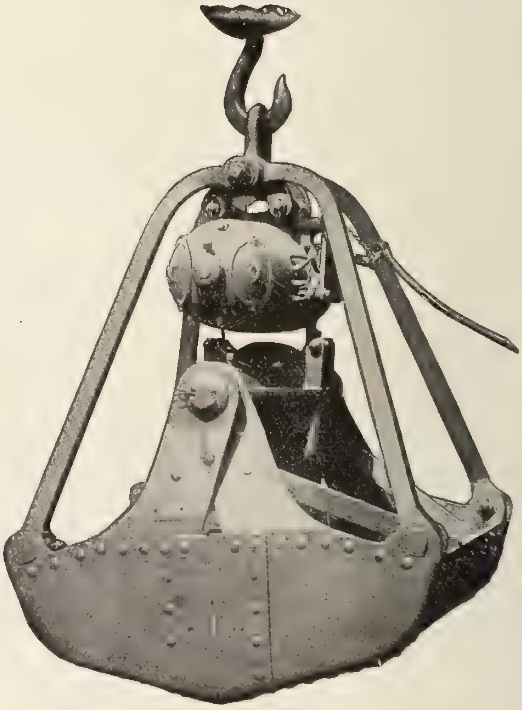
HAYWARD

BUCKETS

Clam Shell Orange Peel

Are designed to stand up under the hardest kind of bucket usage and are built in sizes to meet the needs of all engineers and contractors.

Catalogue on request.

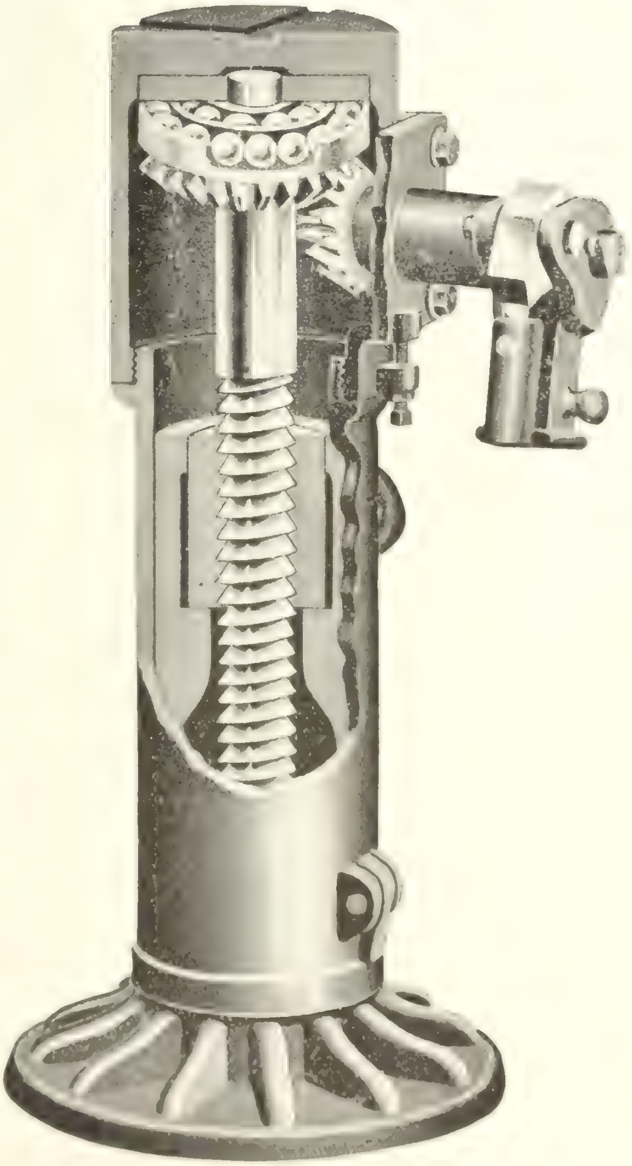

Hayward Electric Motor Clam Shell Bucket

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

Norton Jacks

Ball Bearing
Cone Bearing
Track Traversing
Self-Lowering Jacks



Try one in comparison with any other jack made and be convinced that the Norton is the safest and fastest jack on the market.

Self Lowering Jack

The Norton Self-Lowering Jack is the only real **"Safety First"** Jack made.

It is a mechanical impossibility for this jack to slip or drop the load.

Carried in Stock.

Mussens Limited

MONTREAL 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
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CLASSIFIED INDEX TO ADVERTISEMENTS

The following regulations apply to all advertisers:—Eighth page, two headings; quarter page, four headings; half page, eight headings; full page, sixteen headings.

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Hull Iron & Steel Foundries

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Can. Ingersoll Rand Co., Ltd.
Jenckes Machine Company

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Aikenhead Architectural Iron Works
Canadian Allis-Chalmers, Limited
Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works
McGregor & McIntyre
Meadows Co., Geo. B.
Steel & Radiation Ltd

Architectural Metal Work
Feather & Roadhouse

Architectural Terra Cotta
Northwestern Terra-Cotta Co.
Toronto Plate Glass Imp't'g Co.

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Gillis & Geoghegan

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Mussens Limited
Rock & Power Machinery

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Russell Shale Bricks
York Sandstone Brick Co.

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Ontario Lime Co., Ltd.
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Sutcliffe, Speakman & Co.

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Railway Contractors Supply Co.

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Badger Concrete Mixer Co.
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Jaeger Machine Company
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London Concrete Machinery Co.
Marsh Capron Company
Mills Bros.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.

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Wells & Gray

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Ric-wiL Underground Pipe Covering Company

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Sudbury Construction & Machinery Company

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Sarnia Metal Products Company

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Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

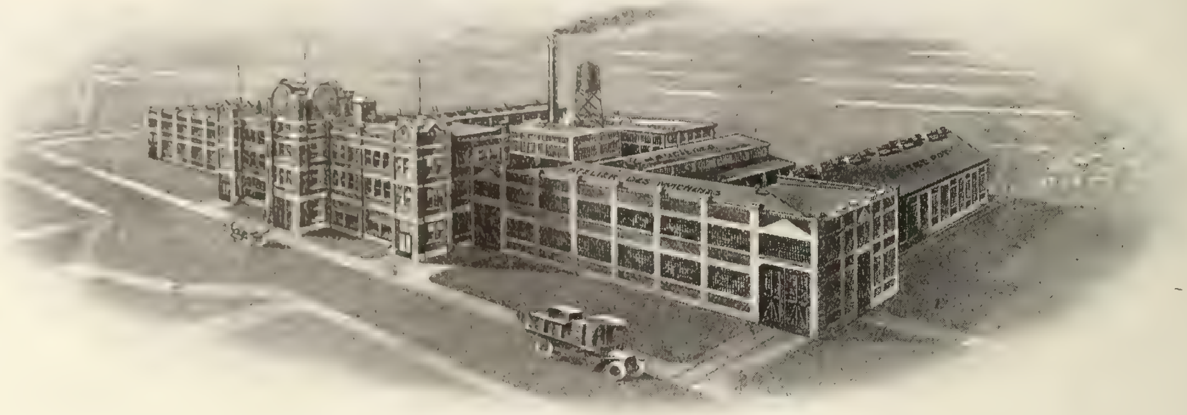
The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your adverti ment. We will save you money.

ESTABLISHED 1886

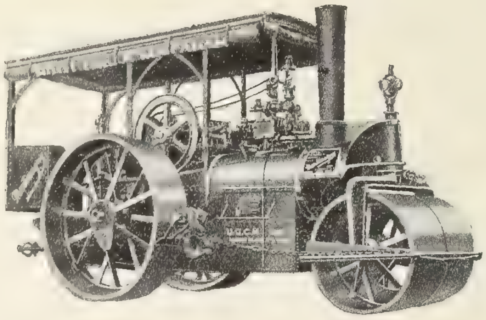
Contract Record and Engineering Review

347 Adelaide Street West, Toronto



Head Office and Works

"Montmagny" Modern Road Builders



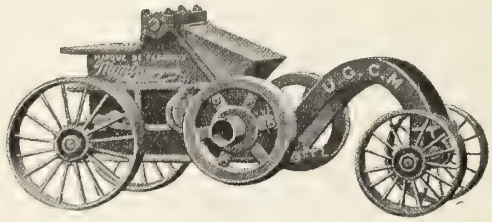
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

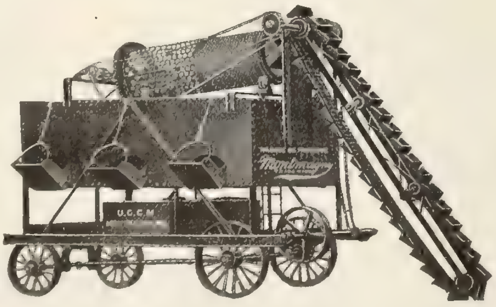
The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



"Montmagny" Portable Steel Bin.

Steel Bin

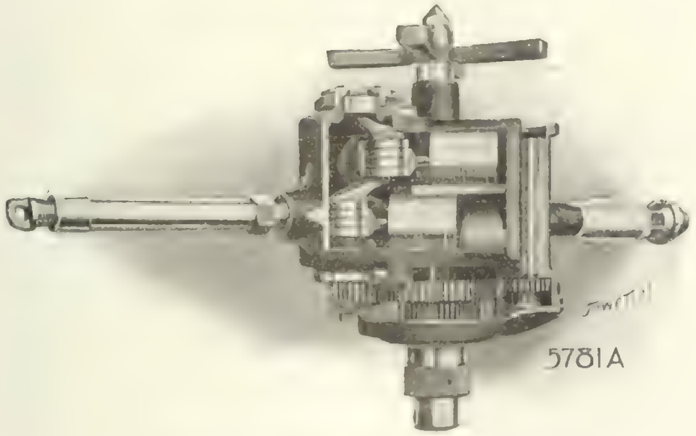
The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec MONTMAGNY, P.Q., Can. Montreal

For Drilling, Tapping and Reaming Metals; For Driving Studs, Flue Rolling and for Wood Boring

USE "LITTLE DAVID" PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

You'll find "LITTLE DAVID" Drills the most satisfactory tools you have ever used.

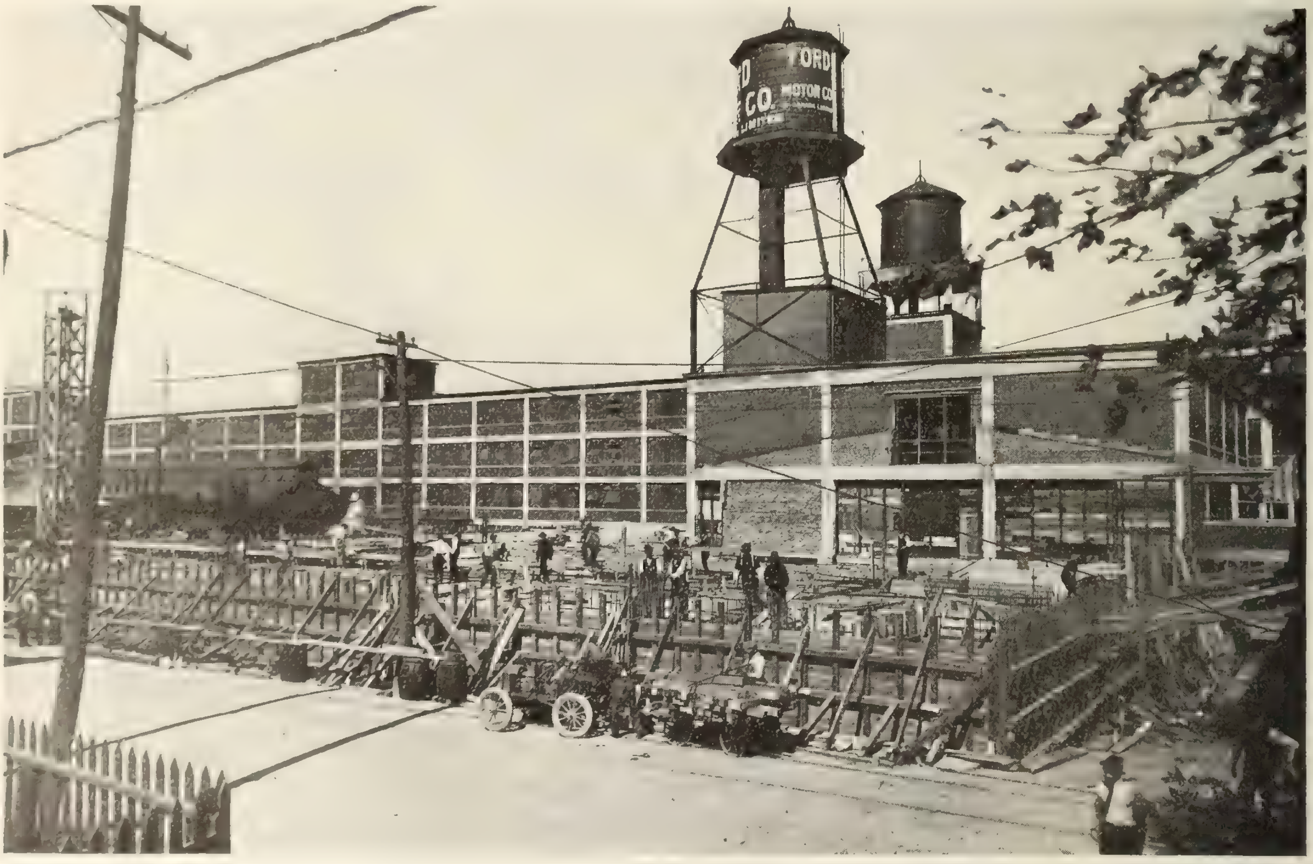
CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver

Wells and Gray, Limited

Engineers and Contractors



Ford Motor Co. Factory, Ford, Ont.

This cut shows building under construction at present time. This building is approximately 175 feet square and is to be 6 storeys in height. In the back ground are seen buildings previously built by us.

Wells and Gray, Limited

247 Confederation Life Bldg., Toronto, Ont.
Branch Office: Royal Bank Bldg., Windsor, Ont

The London Concrete Mixer

A TRIUMPH OF SCIENTIFIC PRINCIPLES.

Once a Specialty—now a question of our output capacity

Our factory is working full time and we intend to work full time, no matter how long the war lasts. Contractors throughout Canada have learned that it is not necessary to go to foreign countries for their concrete machinery and London mixers are second to no other machines in the world. Our prices are less than those asked by smaller concerns, thanks to the contractors who are patronizing home industries in this time when foreign countries are mobilizing their forces with the intent to invade our markets.

We are the Largest Manufacturers of Concrete Machinery in Canada.

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory : Cabell St. and Kitchener Ave., LONDON, ONT.

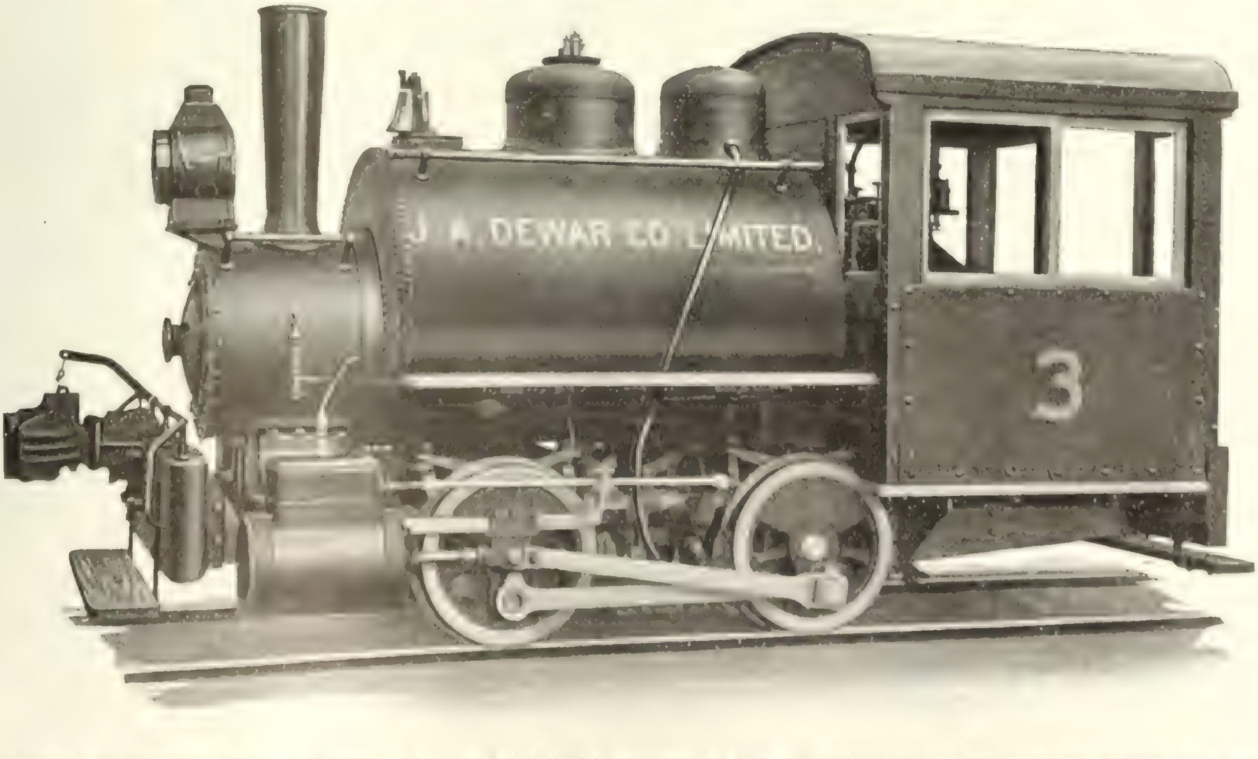
BRANCHES:

Winnipeg—565 Portage Ave.—W. H. Rosevear, Manager
Calgary—622 9th Ave West—P. D. McLaren, Manager.
Halifax—68 Upper Water Street—R. R. Power, Manager.

AGENCIES

Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design [illegible] to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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Drop Forgings
  Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.
  [illegible] Limited
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  Schell Foundry & Machine Co.
  Sheldons Limited

Dump Carts and Wagons
  Deere Plow Co., John
  McNally & Co., Wm.

Drying Apparatus
  Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
  Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
  Gent & Company

Electric Steel Castings
  Electric Steel & Metals Co.

Electrical Supplies
  Northern Electric Company

Elevators
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  Roelofson Elevator Works
  Turnbull Elevator Co.

Enamelled Brick
  American Enamelled Brick & Tile Company

Engines
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  Canadian Buffalo Forge Co.
  Canadian Sirocco Company
  Inglis Company, John
  Jenckes Machine Company
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Rock & Power Machinery

Engineers (Civil and Mechanical)
  Bowman & Connor
  Cape Company, E. G. M.
  Chipman & Power.
  Dominion Engineering & Inspection Company
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  McDougall, Geo. K.
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Excavators
  Beatty & Sons, M.
  Brown Hoisting Machinery Co.
  Canadian Equipment Co.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expanded Metal
  Pedlar People Limited

Fans
  Canadian Sirocco Company
  Sheldons Limited
  Sturtevant Co. of Can., Ltd., B. F.

Fire Hose
  Can. Consolidated Rubber Co.

Fuel Economizers
  Sturtevant Co. of Can., Ltd., B. F.

Electrical Machinery and Supplies
  Ferranti Electrical Co.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Filtration Plants
  verMehr Engineering Co., John.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry
  Mussens Limited
  Pedlar People Limited
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Floor Surface Machines
  Wayvell Chappell & Co.

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.

Gasoline Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.
  Mills Bros.

Glass
  Consolidated Glass Company
  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
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  Rock and Power Machinery
  Royce Limited

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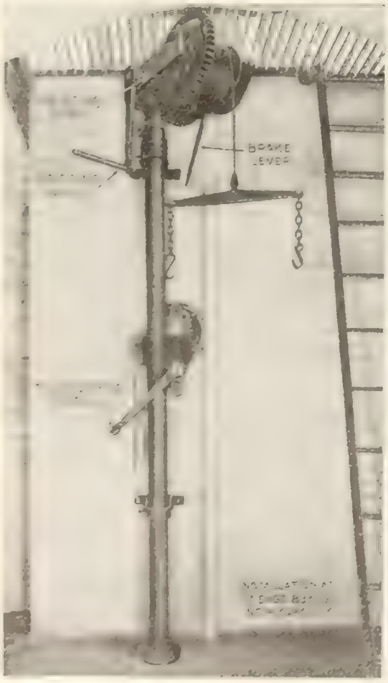
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.

2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.

3.—Simple in construction and absolutely rigid when erected.

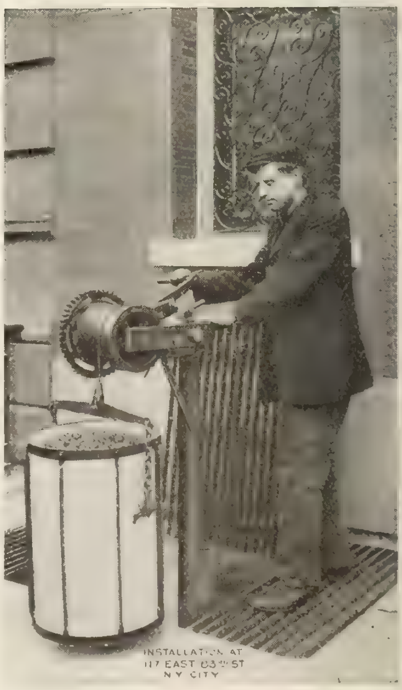
4.—It is made of strongest and most durable material.

5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.

6.—A powerful ratchet device is provided with both handles above mentioned.

7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.



Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Gillis & Geoghegan

549 West Broadway
New York

Black Building Supply Co., Ltd.
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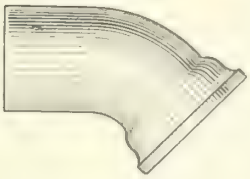
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

W. T. Grose
Agents for Manitoba, Saskatchewan, Alberta
Winnipeg

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

Warren Pipe



Ask us to quote on your next order—any size, 3″ to 60″ diameter, bell and spigot or flange—also special fittings and castings of all kinds.

For fifty-eight years we have manufactured the best quality of cast iron pipe.

Information and prices on request.

Warren Foundry
and Machine Co.
11 Broadway - NEW YORK

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of teriffic usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Northern Crane Works

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- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

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- Central Locomotive & Car Works

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- Standard Underground Cable Co. of Canada, Limited

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- Montreal Locomotive Works
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- Steel & Radiation Ltd.

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- Neptune Meter Co.

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- Canadian Pipe Co.
- Canadian Equipment Co.
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- National Concrete Mfg. Co.
- National Iron Works
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- Browning Company
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- Lecky & Collis

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- Canadian Buffalo Forge Co.
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- Ontario Lime Co., Ltd.

Plate Glass
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- Pilkington Bros.

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Sarnia - Keystone Copper Bearing Galvanized

Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron	V-Crimped Roofing	Conductor Pipe
Plain Black Iron	Metal Siding	Eave Troughs
Galvanized Iron	Valleys	Culverts

Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

Sarnia Metal Products Company, Limited

Sarnia, Canada

For **Permanent** Lines:

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices: BURLINGTON, NEW JERSEY

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No Guess Work

About Luxfer Prisms

The luxfer system of conveying light by glass prisms is an exact science which is being proved daily in thousands of stores, offices and warehouses in every city in Canada.

Some of the cleverest refractionists of the country are with our organization and their skill and experience is at the disposal of our customers.

If you have a lighting problem—bring it to us and we will show you how it can be solved.

Luxfer Prism Company, Limited

100 King St. West, Toronto

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Rock & Power Machinery

Portable Track
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Steel Barrels
Canadian Steel Products Co.

Steel Boxes
Canadian Steel Products Co.

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Malone Steel Concrete Form Co.

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Page-Hersey Iron Tube & Lead Co., Ltd.

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Cabot, Inc., Samuel

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McGregor & McIntyre

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Electric Steel & Metals Co.

Steel Sash
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Britnell & Company
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Hagersville Contracting Co.
Morrison & Co., T. A.
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Smyth & Ryan

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Hamilton Bridge Works Co.
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Maritime Bridge Company
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Reid & Brown
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Toronto Structural Steel Co.
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Dake Engine Company

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Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank Company
Walsh Plate and Structural Wks.

Tarring Machinery
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Pittsburgh Valve, Foundry & Construction Company

Ventilating & Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Company
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Standard Underground Cable Co. of Canada, Ltd.

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Bird & Son

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Cabot Inc., Samuel
Can. H. W. Johns-Manville Co., Ltd.
Can. Supply & Contracting Co.
Ceresit Waterproofing Co.
Wadsworth Howland & Co., Inc.

Water Level Apparatus
Gent & Company

Water Softeners and Filters
American Water Softener Co.
Equipment & Supplies, Limited
Manitoba Bridge & Iron Works

Water Tapping Machine
Mueller Mfg. Co., H.

Water Turbines
Canadian Allis-Chalmers, Ltd.
Boving Company of Canada
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Northern Electric Co.
Standard Underground Cable Co. of Canada, Limited

Wire Guards and Screens
Canada Wire & Iron Goods Co.
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Canada Wire & Cable Co.
Greening Wire Co., B.

Wrenches
Canadian Billings & Spencer, Ltd.

Barrett Specification Roofs

If you should specify merely "a five ply tar-and-gravel roof" instead of "a Barrett Specification Roof"—

You *might* get as good a roof as a Barrett Specification Roof, though built somewhat differently—

But on the other hand, you may get materials of uncertain qualities—

Or a roof with little or no pitch between the layers—

Or a scanty surface coating of pitch and gravel—

And you wouldn't know about it until a few years later — ***when the roof leaked.***

But if you put the Barrett Specification into your building specifications and see that it is carried out, you are sure—

1. That the materials will be right,
2. That they will be used in the right amount and in the right way,
3. That your roof will last upwards of twenty years without another cent of expenditure,
4. And that the cost per foot per year of service will be lower than it could possibly be with any other kind of roofing.

As Barrett Specification Roofs cost less than any other permanent roof to begin with and as their maintenance cost is nothing, the unit cost comes down to about ¼c. per square foot per year, a figure unapproached by any other roof covering.

Copy of the Barrett Specification with tracing ready for incorporation into your building plans sent free on request. Address nearest office.

Special Note [illegible] incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired however the following is suggested
ROOFING - Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

THE PATERSON MFG. CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

[illegible]

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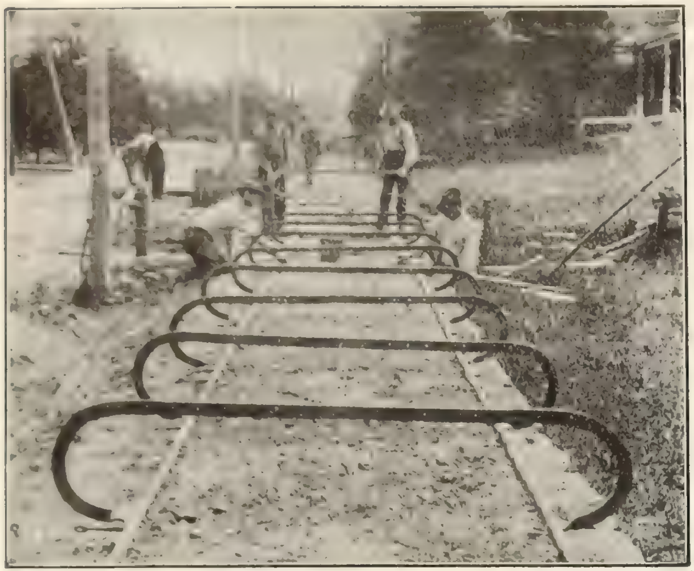

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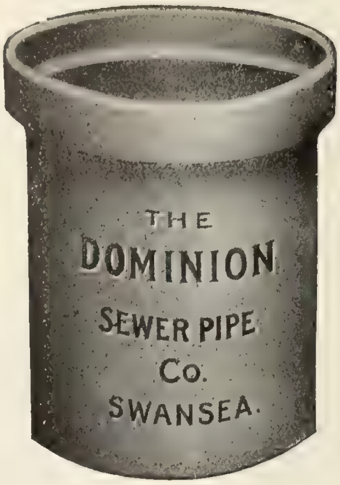

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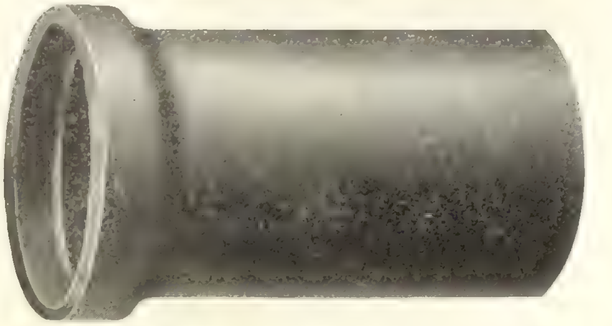

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The Ontario Sewer Pipe Company, Limited

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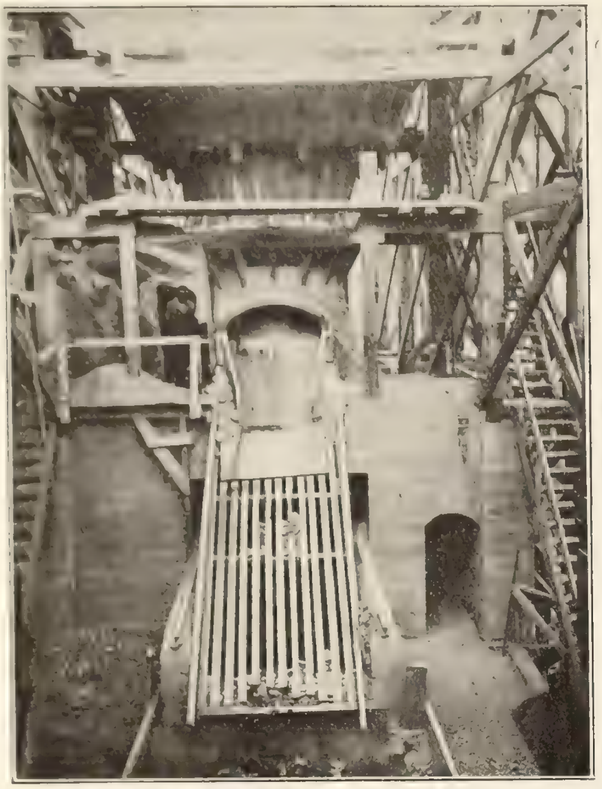

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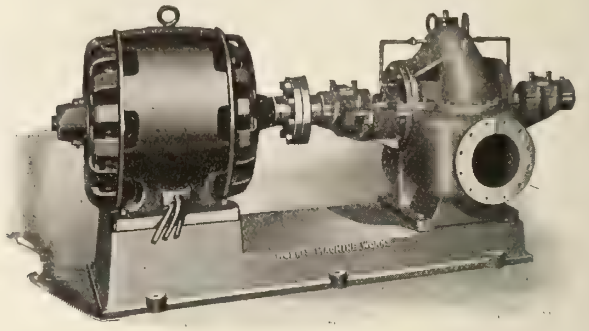

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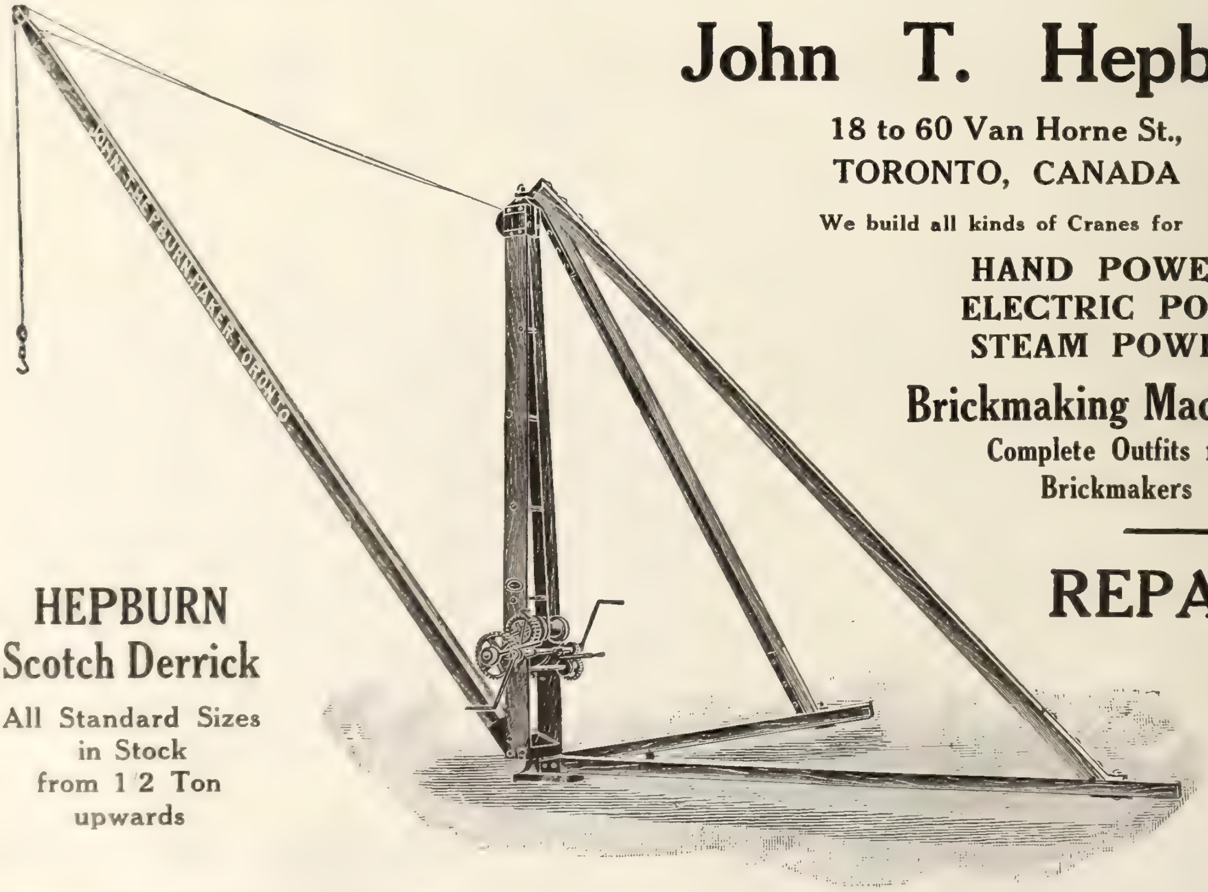
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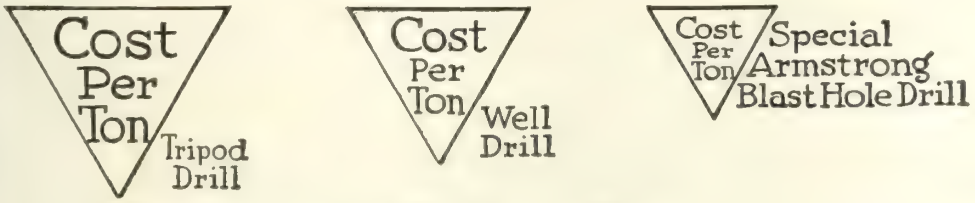
upwards



Comparative Cost per Ton

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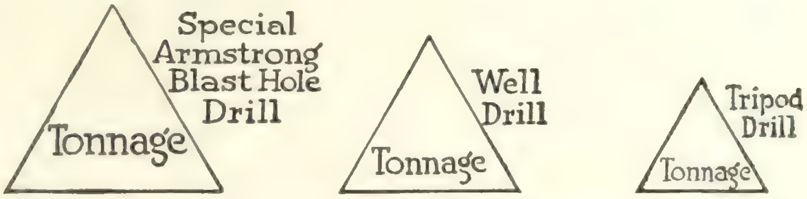


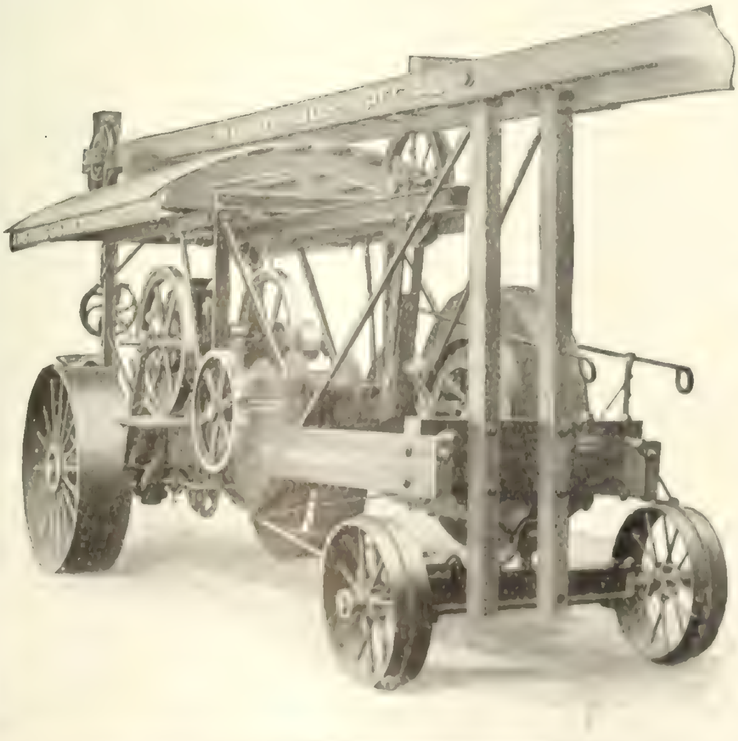
Increased Tonnage at the Same Cost

ISN'T it more economical to shoot out the *whole face* in one blast rather than take the rock out in benches? It saves a big share of the cost of powder per ton of rock—it eliminates several settings of track and movement of machines—it minimizes the delay of your crew and shovel—it reduces the possibility of accidents.

And isn't it more economical to drill the necessary good sized deep holes for face shooting with a drill that releases a quick, heavy, smashing blow at every contact, and at a speed that cannot be obtained by the use of well drills?

It is the efficiency and design of the Special Armstrong Blast Hole Drill that make possible the wide difference in results in comparison with any other method.

Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867



Proof from an Armstrong Owner

Armstrong Mfg. Co., Waterloo, Iowa.

We are glad to advise that the drilling machine recently purchased from your company, according to proposal submitted under date of February 20th, wherein you guarantee to drill a minimum footage of 65 feet per day, has fulfilled the requirements, and we are glad to fulfill our part of the proposal.

A. & C. STONE COMPANY
By John Mernane.

Mr. Mernane made a test with the Armstrong Blast Hole Drill with the following result:

Drilling time—10 days.

Footage drilled—[illegible] feet

Number of moves—40 (11 hr. 59 min. moving time).

Delays caused by rain and moving, changing bit, batteries, etc.—19 hr. 22 min.

Delays caused by rain alone—6 hr. 7 min.

Break in two 200 yd. moves turning machine around—4 hr. 40 min.

Footage drilled per day—72¼ ft.

Footage drilled per hour—9.1 ft. net (7.2 counting delays).

We guarantee the Armstrong Special Blast Hole Drill to drill MORE hole at less cost in a given time than any cable drill on the market, and we will write this in every sale contract we make.

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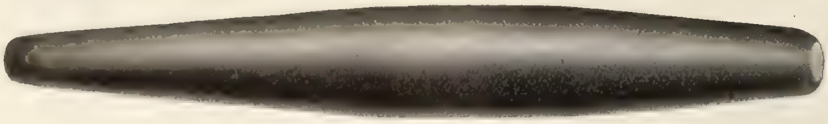

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fit right and wear well

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Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
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3—Exposure to sun and air will not cause its deterioration.
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5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
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Our Engineering Department will gladly furnish free advice and suggestions on any job—without obligating you in the least.

Write nearest Branch for Booklet and full particulars.

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We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

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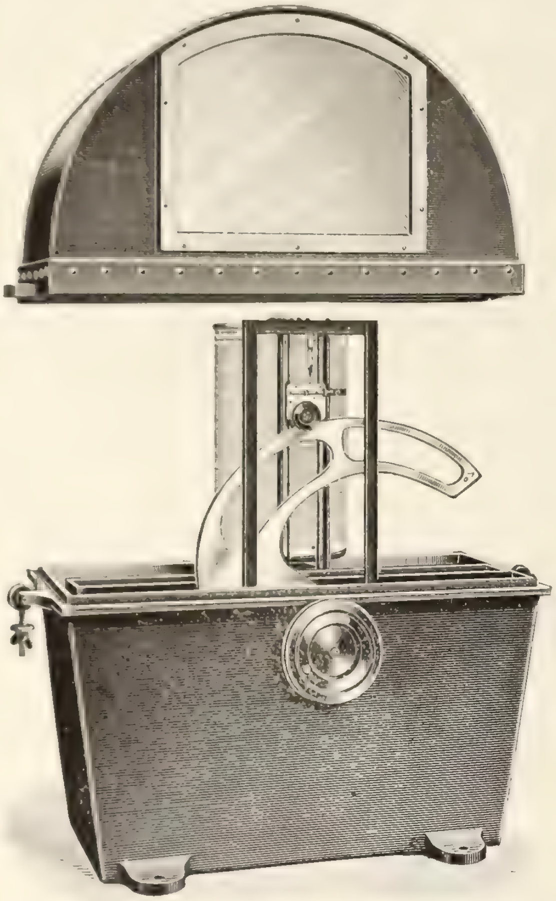
Peterborough, Ontario



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For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

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which contains fullest information about all classes of Water Level Apparatus.

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Fire Hydrants

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Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Calalogue No. 5.

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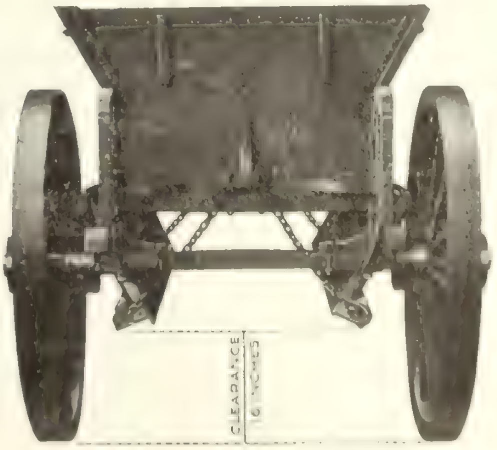

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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Per R. F. Wilson

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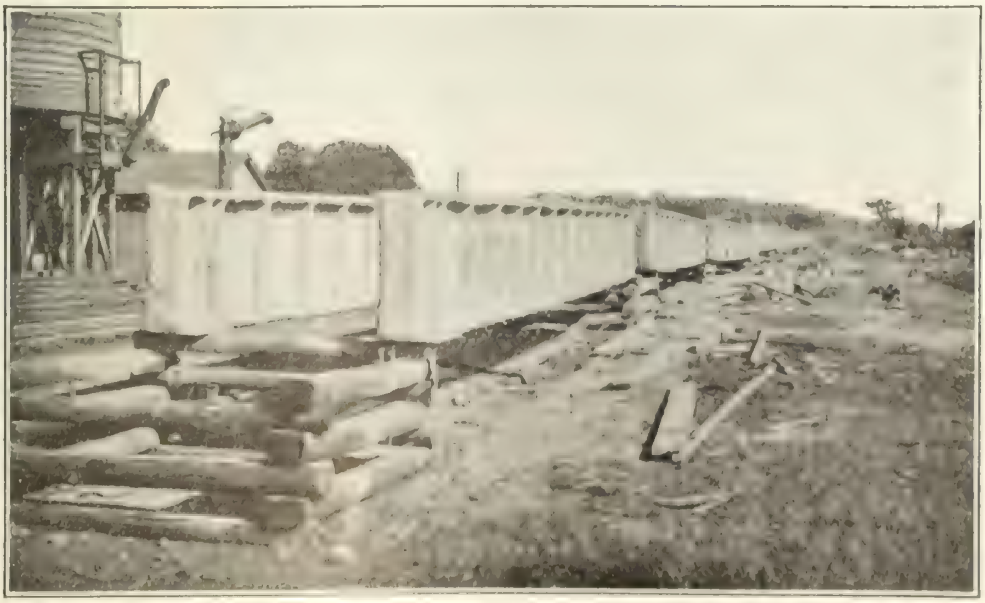
CEMENT-GUN



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Contract signed April 20th, 1914, ornamental iron furnished and erected complete on June 1st.

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ESTABLISHED 1886

Contract Record and Engineering Review

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Side-Tracking Canadian Contractors

With the constructional activity of the season drawing to a close the City of Hamilton is setting an excellent example and showing considerable foresight in engaging upon the construction of a new hotel, the Royal Connaught, estimated to cost $1,000,000. There has been considerable discussion about this project and in certain quarters unfavorable comment upon the award of the contract to a Bostom firm has been made. All are agreed that large constructional schemes of this kind are productive of good effect, not only in providing employment, but in re-assuring people generally by showing them the confidence possessed by a few at least of those who are able to finance million-dollar undertakings. It is contended by some, however, that the principles governing the publicity which has helped to finance this project and the spirit which has animated the award of the contract to a United States firm are inconsistent; further that the employment of Canadians can be guaranteed only by giving contracts to Canadian principals. It is only fair to say that this view is entirely a misconception arising out of an imperfect knowledge of the facts. Upon enquiry we learn that the Boston firm's success in obtaining this contract was due to the fact that they were able to negotiate a considerable block of the hotel company's bonds, representing an investment of some three-quarters of a million dollars. Moreover, the company is an authorized Canadian firm, having a Canadian charter. A condition to which this outside firm agreed was the letting of all sub-contracts to Canadian contractors and the purchasing of all material possible in Canada. It is fair to assume that they will live up to the undertaking.

Certain contractors of our acquaintance seize with avidity upon such cases as these and demand to know whether, if the conditions were reversed, Canadian contractors could look for any business in the States. Here is a case where such argument is unjust and not in the best interests of the country.

Canada is reaching out in all directions for new trade and we must admit of no sentiment calculated to hamper intercourse with the United States. It is "the strong pull, the steady pull, and the pull altogether, boys," which sets things in motion. We need all the co-operation we can get at the present time, and much more can be accomplished by mutual than by detached effort. If U. S. finance has sufficient faith in Canada to invest good money in Canadian undertakings at a time like the present, when conditions are depressed, at the same time undertaking to employ Canadian material and Canadian workmen, by all means encourage them. Let it be remembered that we have not yet reached the stage of independence. We have unlimited opportunities for development, but to prosecute that development we are dependent entirely upon foreign capital. Even the cry of Canadian-made goods is in reality a very distant call, for we have not yet arrived at the point where our manufacturing facilities are anything like equal to the demands of the country's development.

The President of the Hotel Company is Sir John Gibson, formerly Lieutenant-Governor of the Province of Ontario. Doubtless the award of this contract received his personal approbation. The appearance of his name among the directorate of the company reinforces our argument in favor of placing a generous construction upon the policy of bringing in outside capital through contract channels.

Ottawa's "Waterworks Muddle"

WITH its "off agin, on agin" policy of approving and disapproving plans for a new water supply, the city of Ottawa stands forth as the "Finnegan" of the waterworks field, comments Engineering Record editorially. When, after years of controversy, the plan of treating Ottawa River water by mechanical filtration was approved recently by popular vote, it was thought that the last obstacle in the way of actual construction had been removed, but this assumption was premature, for the Provincial Board of Health, as already announced in the Engineering Record, has refused to approve the plans and specifications prepared by Hazen & Whipple, of New York, and indorsed by George W. Fuller and J. Waldo Smith.

This news is discouraging enough, but it is nothing short of startling when its bearing on legislation passed last winter is considered. That legislation provided that, in the event of the disapproval of the Ottawa River plan by the Provincial Board of Health, the city of Ottawa would be compelled to construct the necessary works for the Thirty-One-Mile Lake project, the Provincial Board of Health was empowered to proceed with all construction, assuming for the purpose all of the powers of the city of Ottawa. By the terms of the act the city is prohibited from appealing to the courts for an injuncion to stop the Provincial board in its effort to construct the Thirty-One-Mile Lake supply. The audacity of this mandate is apparent when it is realized that an excellent filtered supply of 35,000,000 gals. daily can be obtained from the Ottawa River for a cost of $2,000,000, while the Thirty-One-Mile Lake scheme, providing for a daily supply of only 25,000,000 gals., will run to $8,000,000. The constitutionality of such an act is open to question and the city undoubtedly will use every means in its power to combat it before submitting to what amounts to an extortion of about $6,000,000.

It is highly instructive to examine into the reasons of the Provincial board's disapproval of the Ottawa River project. They are, in their essence, that the Ottawa River is polluted and that provision is made in the plans for the use of hypochlorite of lime as an after-treatment, if this should prove necessary. As to pollution, the Ottawa River, in its raw state, contains generally something like 200 bacteria per cubic centimeter, and is comparable from the sanitary standpoint, according to the word of George W. Fuller, to Croton Water, which the people of New York drink unfiltered. It must be remembered, however, that the proposal was not to use Ottawa River water in its raw state, but to raise it to a high degree of purity by mechanical filtration. With respect to the use of hypochlorite, the board has distorted Allen Hazen's words, making it appear that the chlorinating treatment is one of the vital elements of the plan, instead of merely a precautionary measure. Mr. Hazen has since stated specifically that a good water can be produced without sterilization. The most ludicrous part of the whole affair is that the Provincial board, two years ago, approved practically the same plan for filtered Ottawa River water that it now feels called upon to reject.

From the whole complicated situation a clear moral can be drawn. As long as boards with no engineering representatives are vested with the power of passing upon the technical details of engineering works just so long will there be trouble. It is stated on good authority that when the plans for the Ottawa River filters were being explained to the members of the board, one of the questions asked was "Is there any sand in these filters?" Little more need be said.

Pro Patria

PROFESSOR C. H. McLeod, Secretary of the Canadian Society of Civil Engineers, acceding to a request made by this journal, has compiled a list of members of the Society who have gone on active service. The names follow in alphabetical order, accompanied by such particulars as to regiment and rank as are available:—

Adams, A. D.; Allen, L. E.; Anderson, T. V., as Major; Armstrong, C. J., as Lt.-Col.; Armstrong, J. D.

Ball, J. C.; Beullac, M. C. J., with the French Army; Bell-Irving, D. P., as Lieutenant with Engineering Corps; Blue, W. E.

Cameron, J. A.; Cardillac, G. de; Charton, P., with the French Army; Clarke, C. P.; Collins, W. S.; Cosgrove, J. R., as Lieutenant; Creighton, F. A.

Daniel, W. T., as Lieutenant; Dawson, S. G., with the Royal Canadian Engineers; Donaldson, J. M.; Donnelly, C., as Lt.-Col.; Downie, R. W.; Drummond, L., as Lieutenant with the Field Engineers; Duguid, A. F.; Dupont, George.

Eaton, H. T.; Erskine, J. A.; Everall, Wm. M.

Fowlds, E. S.

Goldie, E. C.; Greenwood, H. S., as Colonel.

Harcourt, R. H.; Harcon, J. F., as Gunner in Fifth Field Battery, 2nd Brigade; Helliwell, J. G., with 21st Regiment, Essex Fusiliers; Herdt, L. A.; Hertzberg, C. S. L.; Hertzberg, H. F. H., as Lieutenant with 2nd Field Company, Canadian Engineers; Hesketh, J. A.; Hewson, J. H.; Hick, H. C., as Trooper in King Edward's Horse; Hodgkins, F. O., as Captain; Hughes, G. B.; Hughes, H. T.

Irving, T. C., Jr., as Captain with 2nd Field Company, Canadian Engineers.

Lamb, H. J.; Leckie, R. G. E., as Colonel with 72nd Highlanders; Lestang, P. L. G. de, with the French Army.

Macdonald, Campbell; MacPhail, J. A., as Major; McCuaig, G. E.; McDonald, H. F.; McEwen, A. B.; McFarlane, M. L. D.; McNaughton, A. G. L.; Merrylees, L. F.; Middleton, J. R.; Mieville, A. L.; Mitchell, C. H., as Lt.-Col. and general headquarters staff officer; Morrissey, T. S.; Mullon, L. G., with the French Army; Mulock, R. H., with 13th Field Battery.

Nolan, A., as Lieutenant.

Oborn, S. M.; Oxley, A. C., 2nd Field Company, Canadian Engineers.

Patterson, A. L., with 5th Battery, 2nd Brigade Canadian Field Artillery; Perry, R. M.; Peters, H. P.; Pinget, R. C. L.; Power, A. L.; Pym, J. S., as Corporal Signaller, "A" Squadron, Royal Canadian Dragoons.

Rankin, F. S.; Redman, W. B.; Revell, G. E.; Rime, L. M. H., with the French Army; Ross, C. F. D.; Rosher, J. H.; Rutherford, F. S.

Scott, M. A., as Lieutenant, Auto Machine Gun Battery; Shaw, J. B.; Smith, D. A., with Corps of Guides; Spears, D. C., with No. 5 Company, Canadian Engineers; Stavert, W. D., as Lieutenant with 7th Field Company, Royal Engineers; Stewart, J. C.; Stirling, R. A.; Storms, D. H., as Lieutenant with 8th Battery, 3rd Artillery.

Tate, V. H.; Tingley, F. H., as Lieutenant; Turner, G. R., with No. 4 Provisional Company, Canadian Engineers.

Urie, H. R., with 2nd Field Company, Canadian Engineers.

Valter, R. de. 4

Watson, M. B.; Wilkin, F. A.; Wilson, J. A. G.; Worthington, A. N., as Lieutenant with 10th Royal Grenadiers.

A Discussion of the Process of Pumping Wells by Compressed Air

By D. W. Smith, A.M., Can. Soc C.E.

THE air lift as a pumping device was probably first used, we are told, at least experimentally, as early as 1797. Patents of the contrivance have been taken out from time to time in America, but not until late years has it been brought into practical use. Little accurate scientific knowledge was obtained regarding the method up to a few years ago. Investigators during the past few years have taken the matter up, and acquired many valuable facts regarding it, but as the most thorough of the tests have been made by companies, having patents on the market, or manufacturers of air machines, their conclusions and deductions have not become widely known by the engineering profession.

The theory of the operation of the air lift has been fruitful of much discussion, and the principle of its working has been variously stated. The principle of its action is generally conceded to be due to the lessened specific gravity of the water, in which the air is contained in considerable quantities, or through which it is rising in bubbles.

The following is a description of its action from tests made by the Westinghouse Air Brake Company. As the compressed air enters the discharge pipe, slightly above the pressure corresponding to the hydrostatic head, the column of water is forced upward. Air continues to enter, filling up the space left by the rising body of water, until the top of the water column reaches the discharge opening (Fig. 1). The moment that a portion of the rising water is discharged, the weight of the column is thereby reduced and the air below will correspondingly expand, reducing the pressure on the water at the base of the discharge pipe below the air inlet. The weight of the water outside the eduction pipe then forces the water up into the discharge pipe stopping for a moment the inflow of air.

The pressure of the air is quickly reinstated from the supply, so that it again forces an entrance into the discharge pipe. This is repeated until the whole eduction pipe is filled with alternate bodies of water and air rising to the discharge, the combined weight of which is enough less than the water in the well outside the discharge pipe to keep up a continuous flow from the free opening. As each body of air rises, the total weight of water above it grows less, and it consequently expands, until it reaches the surface where it discharges at atmospheric pressure. In this way a continuous flow of water is maintained from the well, as long as a sufficient quantity of air is supplied, and the capacity of the well is not overtaxed. Several methods of applying the air have been used as illustrated by the accompanying views.

Methods No. 1 and 3 are the most commonly used. The well casing, if in good condition may also serve as the eduction pipe, provided proper ratios of air pipe and discharge pipe can be obtained. (Fig. 2.) It is maintained that one [illegible] the other, but some investigators claim that the first method is more efficient because in it the column of water is offered no impediment to its free discharge, the area of available section is greater, and the friction consequently less. It may here be noted, however, that method No. 3 is the most convenient for altering the air line to suit any change in the conditions of the well. Providing the eduction pipe is long enough, the air line may be altered to suit a variety of submergence ratios without lifting the discharge pipe.

Especial advantages have been claimed for various types of air nozzles for releasing the air at the bottom of the pipe. These have been of many forms, including a perforated head, or slotted pipe, a contracted nozzle turned upward or downward, etc. No reliable or accurate data relative to their advantages, if any, over the plain open pipe, are yet obtainable. At the present time probably the majority of applications are from the open pipe only. The size of the air pipe depends upon the quantity of air required, its pressure, and velocity. These in turn depend upon the quantity of water to be raised and the amount of lift, and distance of well from compressor.

The drop in air pressure resulting from friction should be kept as small as possible to insure economical operation. The air piping should be so proportioned as to have not more than five per cent. frictional loss. The size of the eduction or discharge pipe will of course vary with the quantity of water to be delivered. The friction in the pipe of maximum discharge should not consume more than a few feet of head, and the velocity of the water ordinarily should not be over four feet per second.

The following table is submitted as approximating to the proper sizes of air and discharge pipes, corresponding to various charges.

Table 1.

Discharge gals. per min.	Size of Discharge pipe.	Size of Air pipe.
135	3½ inches	1¼ inches
180	4 inches	1½ inches
280	5 inches	2 inches
460	6 inches	2 inches

The depth to which the air pipe is submerged and the consequent pressure of the air required has an important bearing upon the efficiency. The result of tests which have been made show that the quantity of air used per gallon decreases with the depth until a minimum is reached, when it begins to increase. This point of minimum air consumption is the proper submergence, and is usually taken from 55 to 65 per cent. of the total length of air and water column. The submergence is usually expressed, as the ratio of the portion of air pipe submerged to total height of the air and water columns, measured from the point of its application to its free discharge into the atmosphere.

Air Consumption

The formula commonly used to determine the various factors of the air lift problem, is stated thus in Turneaures and Russill's Public Water Supplies

$$Q = \frac{125\ A}{H}$$

In which Q = gallons per minute,
A = cubic feet of free air per minute.
H = Amount of lift in feet.

Having given the quantity of water and the lift,

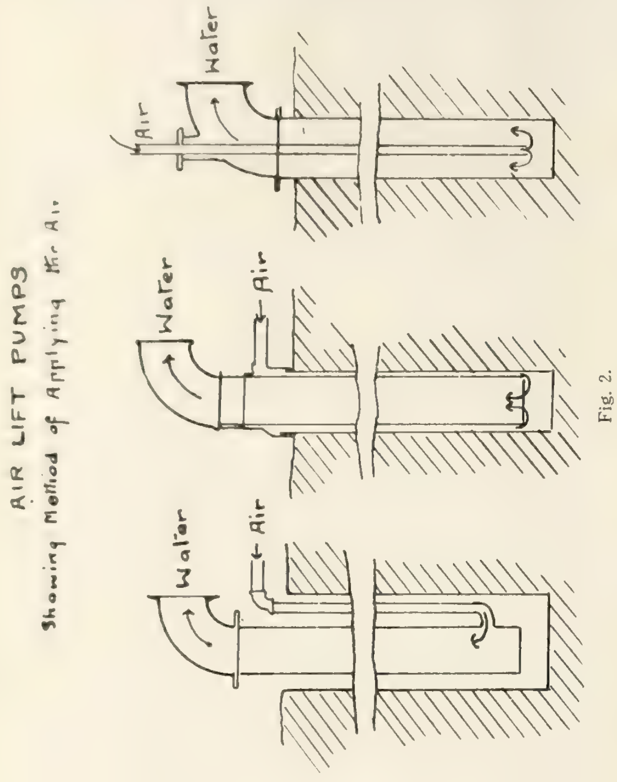
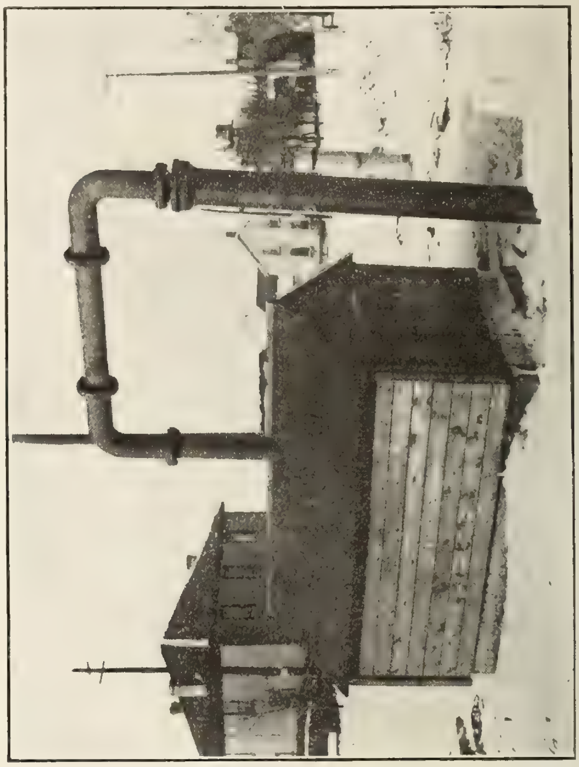


Fig. 2.



Discharge piping of well No. 3.

A Discussion of the Process of Pumping Wells by Compressed Air

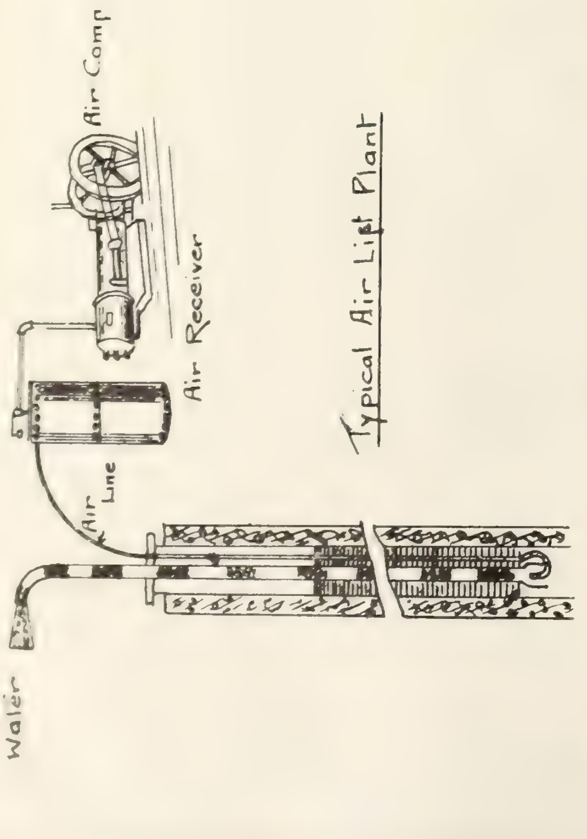
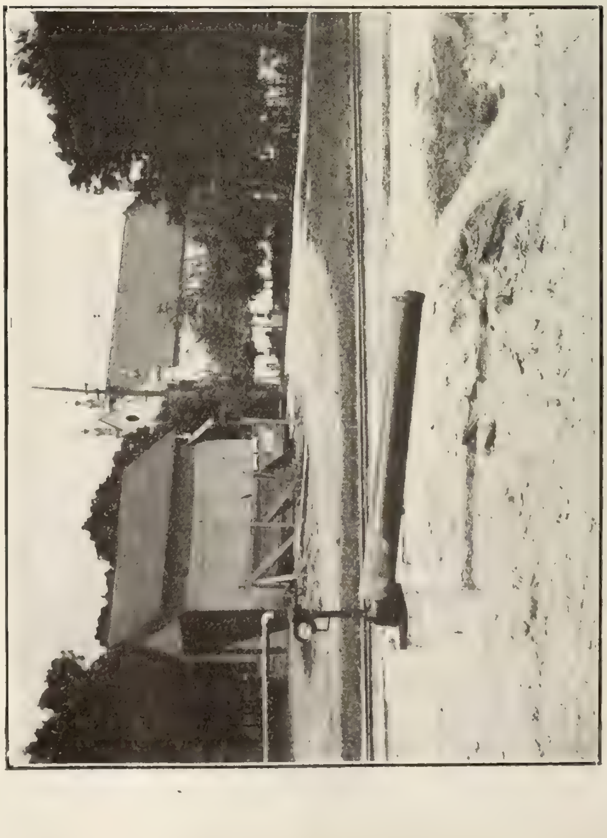


Fig. 1.



Well testing compressed air delivery, 200 ga's. per minute.

Pumping well No. 3 discharging 250 gallons per minute. Measuring weir in foreground.

the quantity of air required is found by transposing the equation to:

$$A = \frac{QH}{125}$$

Air Pressure

The air pressure required for pumping any depth of well will be slightly in excess of the pressure induced by the hydrostatic head, i.e., height of water column measured from the level of the water in the well to the point of air inlet. As the ratio of lift to submergence increases the air pressure decreases.

Application at Palmerston, Ont.

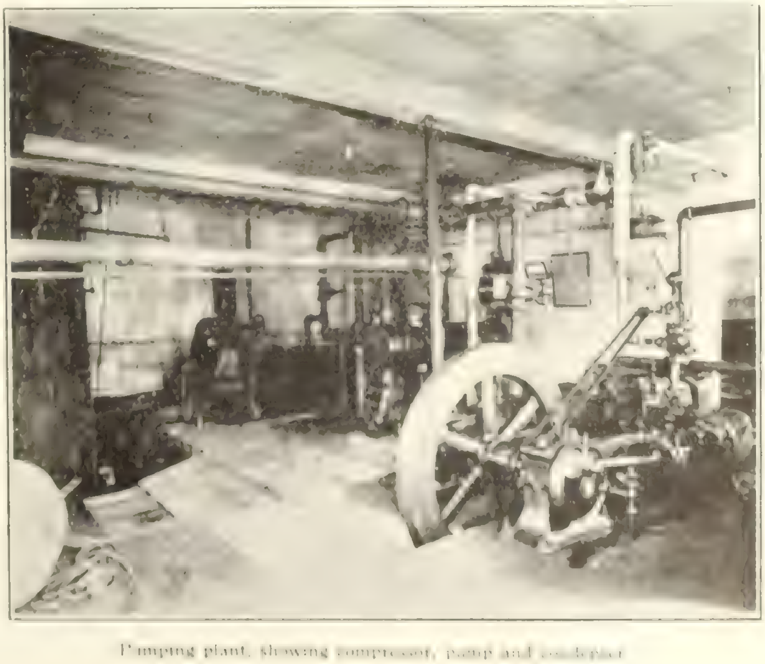
The compressed air method was applied to the civic wells in the town of Palmerston, Ont. A brief description of the wells and the accompanying natural conditions is as follows:

The water supply at Palmerston is taken from the underground limestone strata. This underground supply is tapped by two 8-inch wells, drilled to a depth of about 300 feet below the surface. Water is encountered at about 150 feet from the ground level and it rose to within 16 feet of the surface, before reaching its static level. Under a ten hour test with the air lift these wells each developed a discharge of 250 gallons per minute, the water level in that time dropped from 16 feet to 40 feet below the ground surface. For the last five feet this drop in water level was very slow and uniform, and when at the depth of 40 feet below ground the water level remained practically constant with a discharge of 250 gallons per minute from each well.

The wells were also tested singly and the water level was measured at regular periods during the time of pumping. This was for the purpose of ascertaining the effect of pumping of 250 gallons per minute would have on the body of underground water. The water level in the well, which was located over 200 feet away from the one which was being pumped, fell regularly during the operation, but maintained a level of 10 feet higher than the one in operation, showing that this was the head necessary to force the water being pumped through the sub-strata surrounding the well for a radius of 200 feet. From this, the advantage of locating the wells at some distance apart is evident.

Both wells are pumped by the air lift, and delivered into a concrete storage reservoir, 42 feet diameter and 10 feet deep, containing 100,000 gallons of water. Well No. 2, which is close to the side of the reservoir delivers directly into it. Well No. 3 discharges into the open end of an upturned 8-inch pipe and is gravitated back to the reservoir. As the horizontal discharge from the air lift should not be greater than 30 feet it was necessary to gravitate the water from well No. 3 to the storage reservoir. To provide the head necessary for this and to take care of the splashing which it was foreseen would occur, in the upright pipe, the height of the discharge of well No. 3 was made 5 ft. above the level of the overflow point of the reservoir. An 8-inch return main takes the water from this well and also serves as a supply pipe from the stand pipe to the concrete reservoir. By an arrangement of valves, the storage water in the stand pipe can be connected with that of concrete reservoir and both used for fire service when required. From the concrete reservoir the water is pumped into the distribution mains and standpipe by a compound duplex direct acting pump.

The air lift apparatus installed in the wells consists of a 5-inch eduction pipe placed inside of the 8-inch well casing, and screwed to a patent well head which is connected to the well casing by special flanges. The air line is 1½-inch pipe placed inside the eduction pipe, and is provided with a patented air nozzle, consisting of perforated brass cylinder, attached to the end of air pipe in the well. An air by-pass is taken off the main air line and keeps air pressure on the surface of the water between the discharge pipe and well casing. This is for the purpose of preventing the air surging up between the discharge piping and well casing. The air discharge or outlets were placed at the same level in both wells, and are each about 100 feet below the ground surface. As the water level in the wells is a varying quantity during periods of pumping, it was not possible to obtain a ratio of absolutely correct submergence for all conditions, but it was found



Pumping plant, showing compressor, pump and condenser that a 40 per cent submergence figured for a water level of 38 feet below the surface gave satisfactory results in both wells. The compressor is a compound duplex machine with 12-in. horse-power steam cylinders, 16-inch horse-power steam cylinders and duplex air cylinders 12 inches diameter with strokes of 12 inches.

The compound duplex pump has high pressure steam cylinders 10-in. diameter low pressure steam 16 in. diameter duplex water plungers 12 inches diameter with stroke of 12-inch. Both machines run condensing, being supplied with a Burnham surface condenser, with combined air and circulating pumps. The surface condenser uses the water from the storage reservoir for cooling water, before it is pumped to the stand pipe. The compressor is supplied with an air receiver from which the air pipes are led to the wells. From this receiver, which is placed in the pumping station close to the compressor, a two-inch air pipe is laid to the most distant well, to reduce the friction loss in the pipe. The balance of the air piping is 1½-inch diameter.

Tests

Several tests of the operating efficiency of the pumping plant were made, and it was found that when both wells were discharging collectively 450 gallons per minute into the reservoir, under an average lift of 39 feet 0.38 cubic feet of free air per gallon was required. This is assuming the volumetric efficiency of the compressor to be 80 per cent. When the compressor was running condensing with 20 inches of vacuum, a duty of 16,000,000 foot lbs. per 1,000 lbs. of steam was developed for the pumping apparatus including the compressor. The air pressure in the air reservoir ranged from 31 lbs. at starting to 27½ at the end of a two hour's test.

In starting pumping operations air was admitted at first slowly into the wells, the valves on the air lines being only opened a small amount, allowing the air lines to gradually build up the pressure required. After a lapse of a few minutes the water comes with a great rush, after which pumping operations continue more uniformly. If insufficient air is admitted an intermittent flow will result; the valve should then be opened gradually, until the flow becomes continuous and this is the proper position in which to leave it. The cost of delivering the water depends in the first case on the efficiency of the air compressor, and it is important that the compressor should be carefully designed with properly proportioned valves, and air ports to keep the volumetric efficiency high, and the air as cool as possible.

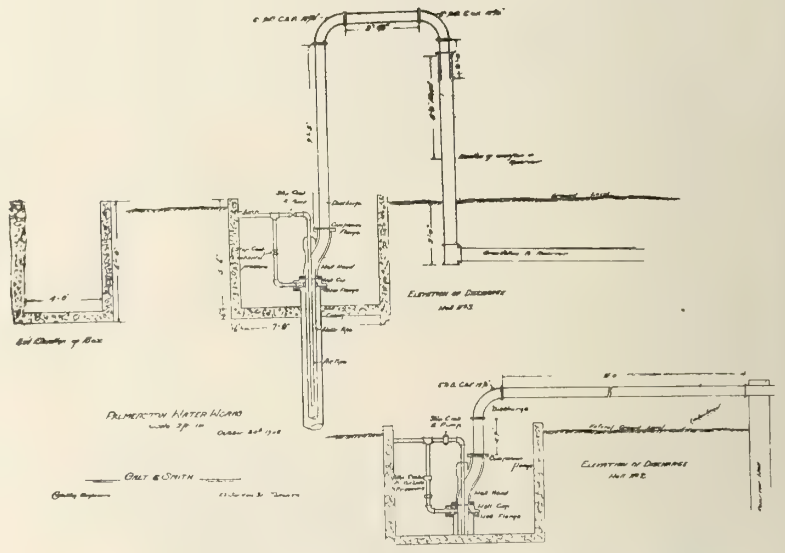
The next care is the proper proportioning of air and discharge pipes and the selection of the correct ratio of submergence of the pipe in the water to the total average lift. The most efficient scheme is the straight lift either to the surface or elevated tank, all long horizontal work being as far as possible avoided. In the air lift pump the ultimate efficiency is necessarily low on account of the many transformations of energy and its poor method of application. One of the principal losses is due to the slip back of a portion of each layer of water in the discharge pipe. Each change in diameter of pipe or irregularities due to joints or curves appears to materially increase this slip.

The economy of the air lift lies in its power of supplying a much greater quantity of water from the same sized well, than deep well pumps, except in cases of low submergence when it would be unwise to adopt this method. There is also economy in the absence of working parts down in the well, thus saving the frequent repairing and replacing common to ordinary deep well pumps, and much loss of time and money. In certain cases there is also great advantage in being able to operate wells placed at some distance apart, from one central air plant.

Properly installed and properly looked after it represents, under certain conditions, the least troublesome and a very desirable system of obtaining water from deep wells.

DISCUSSION

Mr. Thornton, (chairman) expressed his appreciation of the paper and remarked that the cost of installation of such a pumping system as described was quite low.



Method of applying air lift to Palmerston wells.

Mr. Richards inquired if compressed air pumps were used to force the water through the distributing mains, and remarked that if such were the case the water would become well treated.

Mr. Smith replied that other pumps were used in the distribution system, but that the water was aerated in the pumping from the wells.

Mr. Wynne-Roberts related an incident where at Midhurst the authorities wanted to test the capacity of a new well. They decided to make the test without consultation with a competent engineer, and pumped very rapidly, thinking they would get the same results in the eight hours as would be obtained in the ordinary twenty-four hour test. The result was that the reservoir was filled with sand and silt.

He stated that the air lift system was efficient in keeping down silt, etc., but the efficiency was low being only 16 to 20 per cent. He differed with the writer as to the method of discharge, saying that the stream discharged with noticeable gushing under ordinary circumstances. He also mentioned the use of the air lift in multiple stages by which water could be pumped from any depth.

Cement Gun Construction at the Hospital for the Insane, Whitby, Ont.

By H. B. Magowan

THERE is now being erected at Whitby, Ont., a Hospital for the Insane, which upon completion will take a position in the foremost ranks of institutions of its kind. The buildings are being erected upon the shore of Lake Ontario on a site which will be virtually a hospital village, the whole scheme being under the personal supervision of Mr. S. A. Armstrong, Assistant Provincial Secretary. The work is now well advanced.

In all details of construction, the aim has been to adopt the latest and most efficient methods. Perhaps in no sphere of activity is this principle more in evidence than in the plaster and stucco work. The fireproof nature of the construction necessarily involves a large amount of plaster work, and it was at once realized that an immense saving of both labor and time could be made by the use of the Cement Gun. Under the superintendence of Mr. H. K. Heathfield, of New York, this equipment is giving the greatest satisfaction, not only as a labor-saving device, but also from the standpoint of quality of product.

Cottage at Whitby, Ont., being stuccoed by cement gun process. Walls are built of hollow concrete tile, made at Provincial Reformatory, Guelph. Hopper, with valves, hose pipe, nozzle, etc., are shown in the foreground.

Cement gun in action at Whitby, Ont., showing method of spraying the walls. Note iron pipe conveying compressed air to hopper. Compressors are centrally situated at some distance.

In effect, the cement gun is an apparatus designed to discharge mortars directly on to the surface to be coated, by means of a hose and nozzle. After being thoroughly incorporated, the dry materials constituting the mix are placed in a specially designed hopper, whence they are blown by compressed air, along a flexible hose, at the end of which is a double nozzle. This nozzle is furnished with a separate pipe, conveying water, and so arranged that the cementitious materials are mixed with the requisite proportion of water practically at the point of discharge.

It is claimed by the makers that the product of the cement gun, now technically known as "Gunite," is superior in every way to all other mortars. This contention is amply borne out by the results of the work done at Whitby.

This claim to superiority of product is based upon certain definite chemical and physical principles that underlie the method of application.

It is an indisputable fact that when water is mixed with cement, chemical action immediately ensues, resulting in the familiar process called "setting.". It follows, therefore, that any subsequent handling or mixing, such as necessarily takes place in hand-mixed mortars, must interfere with this chemical action in its initial stage, and consequently disturb the set.

In the Cement Gun process, since hydration takes place during the application of the mortar, the cement is in its final resting-place when the setting process begins, and there is nothing to interrupt that continuity of hardening recognized by the best authorities as essential to strength of product.

It might be thought that a considerable quantity of material would rebound from the receiving surface and that this rebound would prove a serious loss. In practice, however, it has been found that while a certain proportion of the projected material does rebound, the rejected material consists almost entirely of sand and water. And since rebounding sand can be used again after drying out, no loss of material need be sustained from rebound. Furthermore, it has been demonstrated conclusively that this apparent loss by rebound is in effect a beneficial factor, it being a natural and selective fore-runner of a dense and homogeneous finish.

The cement gun discharges the mortar with a nozzle velocity equivalent to a pressure head of 35 pounds, so that the cementitious material impinges with considerable force upon the surface to be coated, penetrates intimately the surface irregularities, and so ensures an almost perfect adhesion.

Since all surplus sand and water are expelled by the force of impact, there is in Gunite a commendable absence of the faults so common in ordinary mortars, a fact that has been made evident by many exhaustive tests for porosity and permeability. But apart from the question of superiority of product, the fact that the cement gun has effected an immense saving in both time and labor, is sufficient to justify its use at

One of the cottages after operation with the cement gun.

Whitby, and indeed on any large undertaking of a similar nature.

The application of mortars by hand is of necessity a very costly and lengthy process, inasmuch as several separate coatings are required to obtain the proper body and finish. The cement gun applies any required thickness of plaster in one operation, and this in less time than the first coat can be applied by hand.

At Whitby, the exterior walls of the buildings are being covered, in one operation, with a coating of stucco plaster three-quarters of an inch in thickness. From carefully compiled records it has been computed that an average net surface of 300 square yards has been completed each day.

In the case of the interior walls, and partitions, these are receiving a one-half inch coating of plaster, and the average day's work for this material has been 634 square yards net surface covered.

The material used for exterior stucco consists of Alca lime mixed with 25 per cent. of cement and 5½ to 7 parts of sand, while the interior plaster consists of Alca lime and sand, without cement. Alca lime is made up of 20 per cent. Alca (Calcium Aluminate extracted from a Cuban slag) and 80 per cent. hydrated lime, which is a high magnesian lime.

The Provincial Government have their own lime quarries, kiln and hydrating plant, at the Central Prison Farm, Guelph, where full advantage has been taken of the natural resources that exist there. The high sand-carrying capacity of Alca lime, not only reduces the expansion and contraction of the stucco, and so minimizes the tendency to crack, but also materially lowers the cost. The sand deposits on the Lake front at Whitby provide first-class material for the extensive concrete work that is being done on the new hospital. It being comparatively free from organic impurities, this sand is particularly well suited for stucco.

In operating the cement gun, each nozzle is directed by one man, followed up by two plasterers who put the finishing touches to the gunite, by hand. Another man is required to regulate the valves that control the chambers of the hopper, while additional labor is necessary to mix the materials and feed the hopper.

An exact costing system is maintained at Whitby, and the data already compiled prove conclusively

Another view of stucco-treated cottages. The streaky appearance of the walls is present only in the photo.

View taken from roof of one of the cottages showing central dining hall and kitchen under construction, cottage ready for plastering, and temporary administration building.

that the cement guns in operation there have effected a large saving.

General Features

When completed the new hospital will consist of over forty buildings and will provide accommodation for some 1,500 patients.

In the constructional operations prison labor is being utilized very largely. All walls, partitions, floors and ceilings will be of fireproof construction. The foundation walls are of concrete, run into the forms on the job. The upper walls and partitions are of concrete. Metal lath is used in all the buildings. A new type of reinforced concrete floor, in which an attempt is made to produce a long span floor, avoiding the use of complicated reinforcement, is being tested. The red roofing tile is being manufactured at the Provincial Government plant near Mimico, where also the supply of upwards of a million brick needed in the construction are being produced.

The sewage disposal scheme was planned by Mr. W. A. McLean, Provincial Engineer of Highways. As there are two drainage levels on the site, it will be necessary to collect the sewage from the lower level in a sedimentation chamber and pump it to the main disposal plant for treatment in contact beds. For this purpose an automatic electric pump will be installed, with an alternative arrangement whereby the effluent can be pumped on to the land of the farm for irrigation purposes in dry seasons. The system provides for the convenient removal of sludge; bacterial treatment by rapid filtration through a bed of crushed stone to break up and render inoffensive the organic matter in the liquid; and finally, chemical treatment to destroy all disease-producing bacteria.

The constructional equipment includes a narrow-gauge railway system for transportation purposes, connecting all sections of the work, and a spur line of the G. T. R., built into the property.

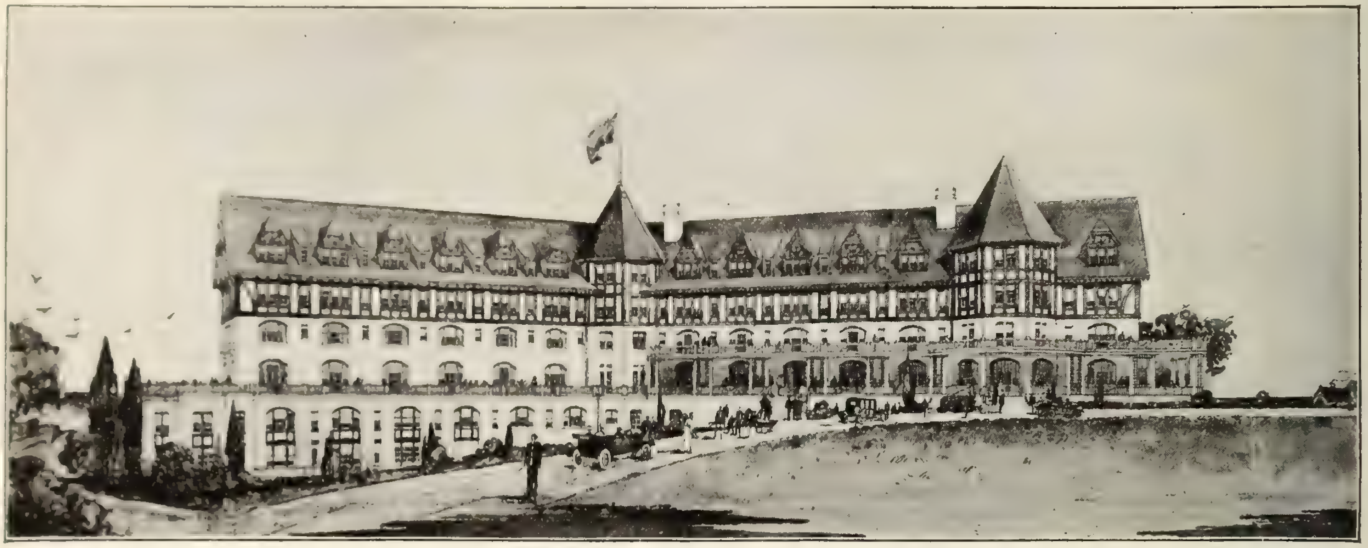
Removal of Wood Block Troubles in Europe

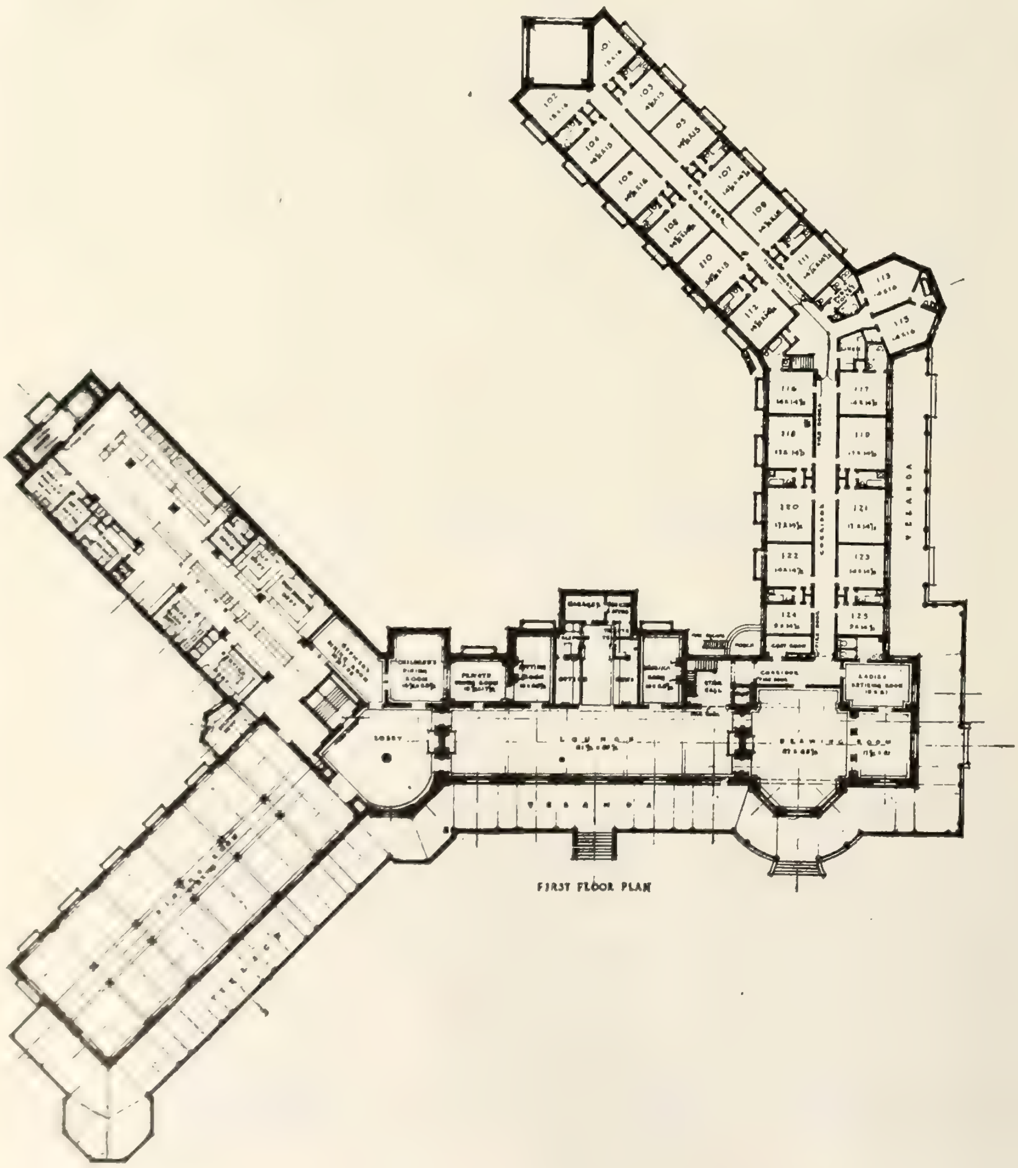
IN a recent paper describing his observations of wood block pavements in Europe, S. R. Church stated that European wood pavements do not bleed, expand or buckle, and are not slippery. He inquired briefly into the reasons to see what we have to learn from their methods. His conclusions follow:

Conditions are so entirely different that I do not see how any direct comparison can be made. In the first place, as to slipperiness, I have already explained that the non-slipperiness of their pavements is due to the use of softer wood. As to bleeding, they seldom have any weather in London hot enough to cause bleeding. In Paris there is not enough oil in the blocks to cause bleeding. The climate also undoubtedly plays a very important part in the question of expansion and contraction. It is agreed that the sudden expansion that sometimes takes place in our wood pavements is due to a rapid absorption of moisture, usually after the pavements have been unduly dry. This can hardly occur in England, where they have a little rain all the time, very seldom any torrential downpours or any long-continued dry spells. The average humidity is high. It is a question whether the pavements ever get dried out to anything like the extent that ours do. I should say that generally the blocks are in a maximum condition of expansion. The same must be true in Paris, or the inadequately treated blocks in that city would certainly bulge. On the other hand, it is well worth considering if the kind of wood that they use has something to do with the lack of expansion troubles. It is manifestly a very different wood from our long-leaf yellow pine. As I have already stated, it does not present as attractive an appearance, and it is probably not so durable. It may be, however, that with short-leaf pine or tamarack or Douglas fir we could obtain results more nearly approaching the European results by following their practice more closely with regard to treatment and methods of laying.

I would also emphasize that the pavements in Europe (this does not apply only to wood) are laid and maintained by workmen who have more conscience, or at least take greater pride in their work than we find on the average job in our country. There is less inspection on the part of the city of the operations of making the blocks and laying them, but I got a very strong impression that the manufacturers are taking no chances of having their material condemned.

In conclusion I want to repeat that in my judgment none of the European wood paving surpasses our best wood streets in appearance.—Municipal Engineering.





FIRST FLOOR PLAN

The New
Algonquin Hotel
of the
Canadian Pacific
Railway at
St. Andrews, N.B.

Architects
Messrs. Barott,
Blackader and
Webster, Montreal.

Contractors
Messrs. P. Lyall &
Sons Construction
Company, Limited,
Montreal.

Design and Construction of the New C.P.R. Hotel at St. Andrews, N.B.

IN April last year the Algonquin Hotel, St. Andrews, N.B., owned by the C. P. R., was almost entirely destroyed by fire. The main building, of frame construction, was completely burned, and only the shells of the two wings were left standing. It was decided to rebuild, and Messrs. Barott, Blackader and Webster, architects, Montreal, were instructed to draw up plans. The contract for the main building was let to P. Lyall and Sons Construction Company, Limited, Montreal, while the restoration of the wings was undertaken by the C. P. R. building construction department, of which Mr. D. H. Mapes is superintendent.

As will be seen by the plans reproduced, it has been decided to adhere to the original plan of a main building with two wings. The hotel will stand on a site covering 28,000 ft. and will be constructed almost entirely of reinforced concrete, terra cotta partitions being utilized in the interior. In order to give an artistic appearance to the front of the main building, a quantity of lumber, embedded in concrete, is employed. The roof is of red slate.

The building, consisting of 4 storeys and two basements, will have accommodation for 200 guests. The basement and sub-basement are, owing to the sloping character of the ground constructed at a lower level than the greater part of the main building. These basements are partly situated in the front portion of the hotel, and are continued under what is known as the kitchen wing. They contain servants' quarters, officers' quarters, helps' dining room, refrigerating plant, bakery, laundry, men's lounge, common room, servery, etc. An open terrace is built over the front portion of the basement, and as higher ground is reached, a verandah is constructed right round one side of the building.

The first floor, entered from the verandah, is arranged so that the lobby is placed between the dining room (41½ ft. x 112 ft.)—the largest room in the hotel—and the lounge (21½ ft. x 89½ ft.). These can also be entered from the terrace and verandah respectively. The drawing room (27 ft. x 38½ ft.) leads off the dining room. Behind these rooms and facing the rear portion of the hotel, are children's dining room, private dining room, sitting room, office, news stand, ticket and telegraph booths, manager's office, smoking room, etc.

The first floor portion of the kitchen wing, which runs off the dining room and lobby, is devoted entirely to kitchen purposes. These include service, dish-washing, cup, vegetable, meat and poultry, knife and glass departments, and officers' dining room. The other wing, leading from a corridor at the side of the drawing room, contains a number of bedrooms.

The entire second and third floors, including the wings, are given up to bedrooms; 97 of these have private baths and 22 have private lavatories. In the attic, bedroom accommodation is also provided, while here is also situated maids' and male helps' quarters, dormitory, and common room.

A boiler house is constructed about 300 feet from the main building. This contains three boilers and two generators for the purpose of providing electric light, power, heat, and hot water.

The keynote of the furnishing is to be simplicity, as becomes a purely summer hotel. Most of the bedrooms and public rooms will have hardwood floors. With the object of minimizing the risk of fire, automatic fire doors have been provided, dividing each floor into five sections, which can be isolated in case of an outbreak. Thus on the first floor there are seven such doors, which can be very quickly brought into operation.

The C. P. R. have in hand all the electrical work; the Garth Company, Montreal, the plumbing and heating; Macfarlane and Douglas, Ottawa, sheet metal and roofing; Murray and Gregory, St. John, a portion of the mill work; while the Otis-Fensom Elevator Company, Limited, Montreal, have the contract for two elevators—one passenger and one freight.

Harbor Improvement Work at Whitby

THE harbor improvement work which is being carried out by the Dominion Government at Port Whitby, Ont., is well under way. Dredging and deepening of the channel was completed some time ago. The contract for a new concrete pier, which was awarded in 1913 to Messrs. P. B. Whitney & Company, of Brockville, Ont., is proceeding rapidly. When completed the pier will be almost 1,300 ft. in length. Of this nearly 1,000 ft. have been completed to date. The foundation timbers of the old pier are being used cavation is carried down to these solid timbers, upon which a floor is laid. It is interesting to note that divers are unnecessary, the water in good weather being clear, so that the work can be carried on from heavy rafts. On the floor large concrete blocks are placed, by means of a steam derrick. On top of the blocks a 4-ft. gravel course is laid. The gravel for this purpose is conveyed from the Lake Shore, where large deposits are found. Two feet of concrete for the finish follow this course, making the structure 10 ft. from foundation timbers to surface.

The concrete for the blocks is poured into wooden forms, being conveyed from the mixer in barrels, one gang being kept busy filling these forms so that sufficient blocks to carry on the construction work are always available. The use of blocks in the substructure allows all concrete which is to be laid under water to set before being placed, thus preventing any disintegration of the ingredients. The top course mix is laid wet in the forms.

The pier runs for about half its length along the water front; the other half projects out with the channel, parallel to the lighthouse pier. Work was commenced last summer and it is expected that it will be completed this season.

Careful attention should be given in the design of reinforced concrete structures to the fundamental principles of mechanics of continuous beams and rigid frames, especially at supports and connections.

System of Unit Concrete Construction as Applied to the Power Buildings at Cedars, Que.*

By John E. Conzelman†

THE hydro-electric plant of the Cedars Rapids Manufacturing and Power Company, which is now rapidly nearing completion, is located at Cedars Rapids, on the north bank of the St. Lawrence River, and about thirty miles west of Montreal.

The term "power house" comprises both the substructure, or dam, and the superstructure, or building proper, the foundations of which are formed by parts of the dam. Fig. 1 shows the general arrangement of the development and also gives a cross section of the power house. The power house extends out from the north bank of the river and closes the lower end of the head-race or basin which is formed by the original north bank of the river and by a rock and earth fill dam which extends up the river from the south end of the power house to the head of the rapids.

The power house superstructure may be briefly described as of structural steel frame construction with concrete walls, floors and roof. The transformer house is a reinforced concrete building, supported on spread footings, with concrete curtain walls. The concrete elements of both buildings were "moulded in advance" and were placed in position after the concrete had hardened; certain portions of the transformer house were, however, poured in the usual way.

The Power House Superstructure

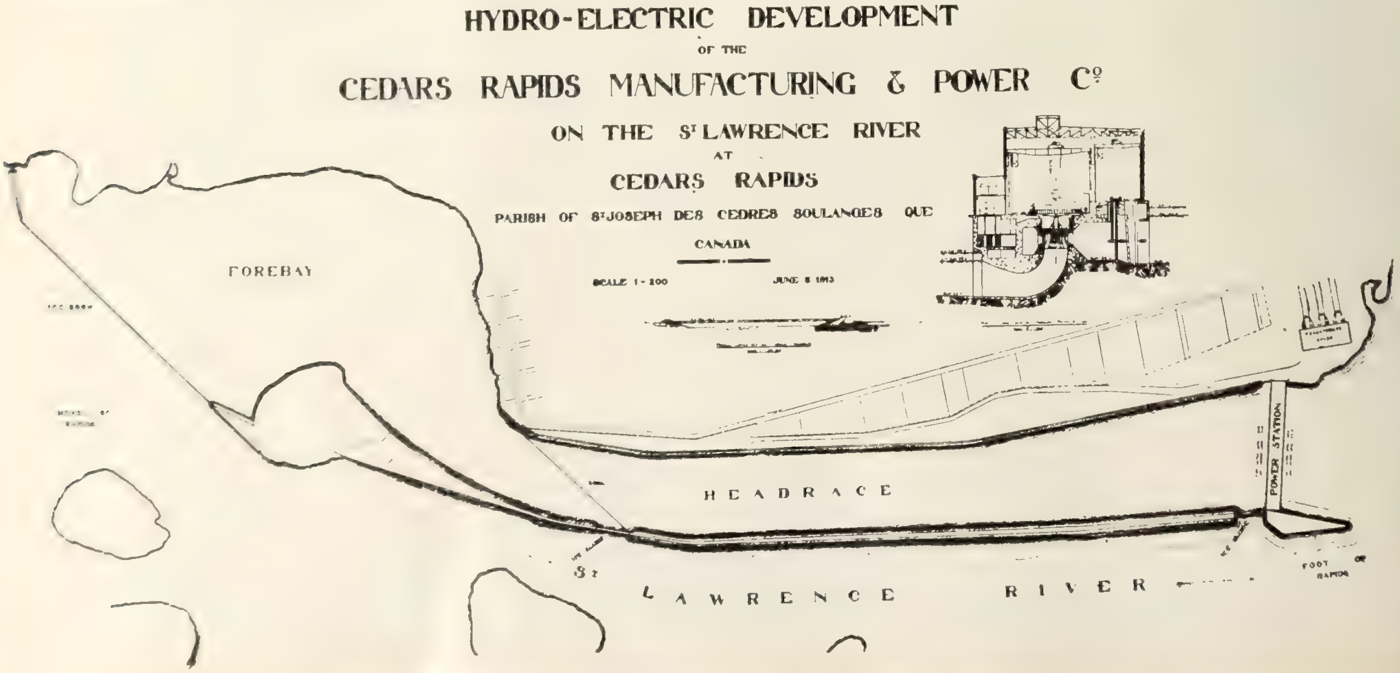
As has been stated, the power house superstructure is built on top of the dam. In order to expedite the work it was necessary that the construction of the superstructure follow closely upon that of the dam so that the mechanical equipment could be installed without delay.

The original sketches called for a steel frame building with brick walls, but this plan was not particularly favored, mainly on account of the expense and trouble incident to transporting to the site the large amount of brick required. There is no direct railroad connection with the property, and carload shipments are sent to Coteau Landing and then transported by barge or car ferry to the company's landing on the Soulanges Canal. The construction of brick walls also necessitates the storage of considerable amounts of materials on the dam. This would have been objectionable as it was desired to leave the top of the dam clear of anything that would hinder the assembling and placing of the turbines and generators.

The question of concrete walls was then considered and this material appeared to be the logical one to use, as the rock excavation was largely in excess of the amount required for the dam and embankments and other concrete work, and the crushing plant could easily supply the required stone. These considerations led to the adoption of concrete walls and roof, and after some study it appeared that a unit method might be well adapted to the construction as there was considerable duplication of parts, and the form work for the high walls and roof would be an expensive item. The matter was finally taken up with The Unit Construction Company of St. Louis. This company reported that the structure was well adapted to unit methods and submitted a tender, based upon their own plans, for the construction of the building. A contract was arranged under the terms of which the contractor was to supply and erect the concrete elements, and was also to erect the steel framework which was, however, to be furnished by the power company.

The details of the concrete work were made by the contractor and the details of the structural steel work were prepared under the direction of the Cedars Rapids Manufacturing and Power Company. The details were finally co-ordinated and the manufacture of units was begun in September, 1913. Casting was continued until cold weather set in and about fifty per cent. of the units for the power house were cast out before December.

It had been contemplated to start the erection of



General plan of Cedars Rapids Manufacturing and Power Company's development.

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*From a paper before the Canadian Society of Civil Engineers, Montreal.

†Chief Engineer, Unit Construction Company, Montreal.

the building some time in October, but it was December before the construction of the dam had progressed to a point where the erection of the steel frame work and units could be started. The erection was continued throughout the winter, but the exceptional severity of the winter, combined with the exposed position, made the erection slow and troublesome. Nevertheless by March 1st seven bays of steel work had been erected, equivalent to a length of 116 ft. 8 ins. of building, and five bays had been closed in with units.

The power house as now built is 642 ft. 4 ins. long and 124 ft. 11½ ins. wide over all, and consists of 35 typical bays 16 ft. 8 ins. long and 3 special bays 18 ft. 4 ins. long; and is arranged to accommodate ten generators, three exciters and ice sluices.

The steel framework was supplied and fabricated by the Phoenix Bridge and Iron Works of Montreal. The roof trusses are designed for a load of 100 lbs. per sq. ft. The crane girders and columns in the main aisle are designed to carry two 150-ton capacity electrically operated travelling cranes. The steel work in the gate house is arranged for a thirty-ton capacity crane. The high columns were spliced at the level of the crane girders.

All connections, except the butt joints between the ends of the crane girders, were rivetted. One expansion joint is provided.

Walls.—All the exterior walls are twelve inches thick and consist of two independent concrete slabs four inches thick, with an air space between. The steel columns were provided with slots to receive the slabs (which were lowered down from the tops of the columns) and after two opposite slabs had been set, they were held apart by a piece of one-inch plank which fitted into notches in the slabs. This board also served as a form for the grout which was poured into the space between the column and the slabs. The purpose of this grout is to hold the slabs in place and also to protect the columns against corrosion. The concrete pilasters were cast in place after the slabs had been erected. The window sills and some of the jambs around the windows were made solid, 12 ins. thick. The doors are of wood covered with copper. The window openings are equipped with rolled steel sash glazed with two thicknesses of double diamond glass, with an air space ¼ in. thick between the lights. The monitor is similarly glazed and the ventilating portions are moved by operators extending down to the level of the main floor.

Roof.—The roof consists of reinforced concrete slabs or units. The roof units consist of a reinforced concrete plate 3 ins. thick cast integral with the beams, which are carried around the [illegible] sides, the entire unit resembling the cover of a box. The units are 16 ft. 6½ ins. long and 16 ins. deep over all; those adjacent to the walls, however, have a special slope as shown on the section. The entire unit acts as a beam between trusses; the reinforcement in the beams acting as the tension flange and the entire slab providing compressive strength. A uniform distribution of load on the trusses is assured by the stiff end beams of the units, and the mortar bed upon which the units are set. The roof units are so dimensioned that a space one and a half inches wide is left between the ends and over the centre line of the trusses. These spaces, as well as the spaces between the slabs themselves, are filled with grout. Reinforcing bars three feet long are placed in the space between the units and extending over the trusses. These bars form an effective tie after the grout has hardened. Concrete saddles were formed on the roof for the purpose of directing the water to the downspouts. The roof covering is 4-ply Barrett specification material mopped directly to the concrete. The down spouts are of 18 oz. copper and are brought down inside the building.

The floor of the switchroom, which extends the full length of the power house, was constructed in the usual way, as was also the floor of the tank room which is 3 bays long.

Erection of Units and Steel Work.—Construction was started at the shore or north end of the power house. The structural steel and units were brought to the building on flat cars over a trestle which connected with the high part of the dam. All of the erection was done by means of a structural steel stiff-leg derrick mounted on a triangular steel tower sixty feet high. This high tower and the 84 ft. boom made it possible to complete the erection for the full width and height of the building as the derrick was moved back. The units are provided with lifting hooks or bent steel bars which are imbedded in the concrete when the unit is cast. After the units are in place these hooks are cut off. The weight of the heaviest steel member was about 5¾ tons; the heaviest unit handled weighed about 8 tons.

Manufacture of Units.—The location of the unit yard is shown on Fig. 1. The cement shed was located along a material track and had a capacity of 5,000 barrels of cement; sand and stone were received in six-yard side dump cars. The concrete materials were wheeled to the mixer and water was taken from the Soulanges Canal by a small steam pump operated from the mixer boiler. The mixer discharged directly into distributing buckets of the controllable discharge type and the buckets were handled by a 15-ton Browning locomotive crane with a fifty-foot boom, operating on the yard track. This track extended the full length of the casting yard (about 400 feet), and the forms were disposed on each side of the track for a width of 50 ft.; allowing a strip ten feet wide for the track, the effective area of the casting yard was 36,000 square feet. The forms were supported on 4 in. x 4 in. sleepers which were carefully levelled and bedded on the ground. The sides of the roof slab forms were covered with sheet metal to assist in easy withdrawal of the unit from the forms.

Lifting hooks were cast into the units at convenient places and as soon as the concrete had hardened sufficiently the units were raised from the forms by the locomotive crane. They were then as a general rule taken to the storage yard for further curing, or were placed on flat cars and taken directly to the building.

The detailing of the units involved considerable work; each unit was detailed on a separate sheet and given a distinguishing mark or number which corresponded to the marks shown on the erection diagrams. There are 3,916 units in the power house and 1,602 in the transformer house, the total amount of unit concrete in both buildings being 6,111 cubic yards.

The transformer house is constructed entirely of reinforced concrete and is a four-storey building, with basement. The foundations rest on hard clay at a depth of about seven feet below grade and are designed for a load of 4,000 lbs. per sq. ft. The building is [illegible] ft. long and comprises ten bays twenty feet long and four bays seven feet long.

In order to accommodate the transformers, which occur in groups of three near each end of the building a special column spacing was used. A length of 47 ft. of building was divided into three equal spaces of 15 ft. 8 ins. each instead of the typical spacing of 20 ft. and 7 ft. Above the third floor typical spacing was used and the columns on each side of the 7 ft. bay are carried by reinforced concrete girders.

The roof is designed for a load of 100 lbs. per sq. ft., the upper floors for a live load of 250 lbs. per sq. ft., except where special loadings occur. The ground floor is of very heavy construction and is designed to support the transformers which were estimated to weigh 75 tons, and also to support a standard gauge track, upon which the special track, or car, for handling the transformers, is to be operated. In addition to the live loads specified all floors were designed for a six-inch concrete finish. The load requirements necessarily resulted in very heavy construction.

The exterior walls consist of concrete slabs 10 ins. thick with a two-inch air space in the centre; the air space was formed by means of a sand core, the sand being washed out before the unit was set. The ends of the building are closed with 6 in. tile walls plastered on both sides as it was desired to have these walls easily removable should the building be extended. The basement walls are 12 ins. thick and are constructed of reinforced concrete except at the ends of the building where brick is used. Below grade the walls are tarred and a drain is provided around the building at footing level to intercept any moisture that may seep in.

On account of the special construction of the ground floor, and because of the lack of duplication, it was decided to construct this floor in the usual way, as well as the extremely high columns which extend about 35 ft. above it.

It had been hoped also, that this division of the work would expedite the construction. It was expected that the foundation and first floor could be completed in the fall of 1913, and that while this work was going on the manufacture of units would be progressing at the casting yard. It was impossible to carry out this programme, however, on account of numerous delays, and it was the end of October before the excavation was started. As a result winter set in when only the footings and a part of the basement walls had been poured; although the forms were up and the reinforcing steel was in place for one-third of the ground floor.

The bottom of the footings was about 3 ft. 6 ins. below the basement floor, and the ground is stratified clay, which is very dense and extremely hard when dry. Shortly after work had been discontinued the excavation filled with water to a depth of almost three feet. This water came in under the snow probably from broken water pipes. It was thought that this heavy snow and ice would prevent the frost from reaching the bottom of the footings. Levels in early spring, however, indicated that there had been considerable heaving. Trenches were dug around some of the footings, and an investigation showed that the water had penetrated the soil, and that between each strata of clay there was a film of ice. The clay strata varied in thickness from ½-in. to 1-in., and the ice films from an inappreciable thickness to 1-16-in. As the construction of the building could not be delayed it was decided to dig a trench around each footing, and thaw out the ground with steam. Some of the footings were 12 ft. x 22 ft. in plan, so the difficulties were somewhat formidable. However, trenches were dug and steam pipes inserted under each footing and kept there until the escaping steam came out on all sides. The treatment was continued until samples showed the ground to be quite hot; the water was then drained away and a form built around the footing to a height of 6 ins. above the bottom. A cement grout was then worked under the footings. This method has proved effective as careful levels have failed to detect any settlement. The net result of the whole operation indicated that time would have been gained if the foundation work had not been started until this spring.

Unit Details.—As stated, the building above the ground floor was constructed according to the unit method. The columns, girders, floor slabs and wall slabs were made at the casting yard and were placed in position by derricks. The continuity and rigidity necessary to a concrete structure of this type was obtained by means of overlapping reinforcing bars which were concreted in after the units were set. The floor slabs rest on the girder ledges for their entire width and the top of the slabs is three or four inches above the top of the girder, forming a grouting space over the girder. Projecting bars extend into this space from both girder and slabs, and this space is filled with concrete. Experience and laboratory tests show that after the grout has hardened the girder is greatly strengthened, in fact T-beam action results. The load was applied at the third points. The simple girders failed in compression, the wing girders in tension. The stress in the steel was computed from the observed extensions. Small holes were drilled into the bars, eight inches apart, at the centre of the span, and the extensions were read to the nearest one ten-thousandth of an inch by means of a special apparatus. Temperature corrections were applied to all readings. The deformation of the concrete was also observed in a similar manner by means of steel buttons set in the concrete 8 ins. apart.

View of power-house—Up-stream side.

Referring to the data on the wing girders it will be seen that the deformation of the concrete wings agrees closely with that of the grout over the girder; this indicates that the wings carried their full share of the compressive stress. In this particular series of tests the compound girders failed at double the load causing failure of the simple girders.

Erection.—A track was laid along the north side of the building and the units were brought down from the storage yard on flat cars. Two derricks were used for the erection. Derrick No. 1 operated on the ground floor and set the building complete to the level of the third floor as it moved back. As soon as the erection had progressed sufficiently Derrick No. 2 was set up on the third floor. This derrick completed the erection up to the roof level as it moved back. These are stiff leg wood derricks, steam operated, with 75 ft. booms.

To complete the erection the lower derrick was placed on the roof and in this position was used to dismantle derrick No. 2, and set the remaining units. The erection of this building proceeded somewhat more slowly than was anticipated, and the delays were mainly due to the interference of the high columns (which had been poured in place) with the movement of the lower boom.

The main transformers are placed on the ground floor; each transformer having its separate compartment formed by solid plaster partitions. The reinforced concrete girders carrying the transformers were designed for a load of 75 tons and extend above the floor level two feet. The transformers rest on 60-lb. rails placed on top of these girders.

All the partitions, with the exception of a six-inch unit wall which extends the full length of the building on the first floor, and some tile and glass partitions around the office, are two-inch solid plaster partitions —cement mortar on metal lath and steel studs. The partitions between the lightning arrester compartments and the transformer stalls are double partitions. The doors to the lightning arrester compartments and those in the partitions on the high tension floors are of wire mesh on steel frames, and are provided with high grade locks.

The roof covering is similar to that of the power house; all metal flashings, except at temporary ends, are of copper. The downspouts are carried down inside the building and are 5-in. wrought iron pipe. The window openings are equipped with rolled steel sash glazed with two thicknesses of glass as in the power house.

As the method of construction which has been used for these two buildings is comparatively new, it may be of interest to say a few words in regard to it. There have been a few buildings constructed of members, moulded in advance, but so far as the speaker is aware, the Unit Construction Company alone has extended the scope of this method so that it can be applied to the construction of almost any structure that would normally be built of reinforced concrete. The basic principle upon which their method is founded is that the necessary stability and rigidity can be obtained, if the joints, which consist of overlapping bars projecting from the units and surrounded by concrete poured after the units are set, are properly made. This principle being admitted the next step is to insure that the bars overlap sufficiently to develop the requisite bond, and are surrounded by a considerable body of grout so that the necessary stresses may be developed.

The chief advantage claimed for this method of construction is that the units can be made under what may be called factory conditions. The forms are strongly built and are carefully bedded on the ground, this makes the proper inspection of the forms and reinforcement an easy matter. Moreover, the unit can be inspected and tested if desired before it is incorporated into the structure. The reinforcement is easily held in its proper position, and is not so likely to be displaced as in a monolithic building where there is always considerable walking over the steel that has been placed.

The location of construction joints is often a puzzling problem in the usual concrete building; with the unit method these joints occur exactly where the designer wants them. There is also more certainty in a unit design as the loads are carried by a definite system of units and not in a more or less ambiguous way as is the case in monolithic construction.

Unit methods are not advisable for all reinforced concrete structures, but for those consisting of a series of similar bays involving a great duplication of parts the method is often the obvious and elegant one. In the case of the power house just described it was certainly an advantage to be able to cast the units some time before the dam or foundation was ready to receive the superstructure.

Constructional Activity in British Columbia

The 5-mile tunnel being driven for the Canadian Pacific Railway under Rogers Pass at Glacier, B.C., at an estimated expenditure of $10,000,000, is an undertaking which is being pushed as rapidly as engineering skill can show the way. On the east end the pioneer bore had been advanced about a mile on October 1, while the 8 x 11-ft. centre heading and the full tunnel section had been driven in 3,100 and 400 ft. respectively. On the west end a 300,000 cu. yd. approach cut was finished, the pioneer bore advanced 1,600 ft., and in the main tunnel portal five small headings had been driven several hundred feet.

At New Westminster there is nearing completion the first unit of an extensive scheme, to cost many millions, for the Fraser River harbor development. Features of this work are the methods of handling material by 150 h.p. electric cranes and a dipper dredge, which were built especially for the work and are supplemented by a Fruhling dredge rented from the Dominion Government. At Vancouver work is actively under way on the joint sewerage scheme and some of the largest trunk sewers in Canada are being built. Sewer contracts totalling $450,000 are to be let shortly.

The Canadian Northern Railway has at present some 86 miles of line and several bridges to complete before trains can be sent through to Vancouver, but it is expected now that the last spike can be driven soon after the first of the new year. The structures for the shops at Port Mann are completed. The Grand Trunk Pacific Railway has practically finished construction on the main line and a regular train schedule has been established, but several thousand men are still at work constructing the branches running southward to Vancouver from Fort George and northward from the latter point to the Pine River Pass.

At Victoria the 10-mile line of 36-in. steel pressure main in the new water supply system was successfully tested under a maximum pressure of 200 lbs. per square inch on October 8. Construction on the 27-mile concrete pipe line, which is 42 ins. in diameter, is well under way. The steam treatment used to hasten the setting of pipe in the molds was unsatisfactory at first and for a while about 15 per cent. of the pipe was culled. However, a more suitable steaming process has been worked out after considerable experiment and culls now amount to a negligible quantity.

The Government breakwater and piers at Victoria are now in the stage where work begins to show above water level. Pouring has commenced on the first two of the concrete cribs, which are to be floated into place and sunk in position as foundations for the superstructure.—Engineering Record.

Features of the Principal Types of American Wharf Design*

THE selection of a proper type of wharf construction, proper not only for the port as a whole, but also for the particular commerce to be handled, is a most insistent problem. No precise formula serves to solve this problem for given conditions. Policy frequently affects the selection of materials for construction and thus frequently the design or type. Finances form another of the factors in the selection of port types.

The majority of our important ports have developed under the pier and slip plan. Provided the fairway or harbor is not too narrowed for ready navigation by the projecting piers, this system has the decided attraction over quays of providing far more wharfage per linear foot of shore front. Desire to secure this greater wharfage has resulted in such narrow piers (50 to 75 ft.) and narrow slips as to cause costly congestion in the handling of merchandise and in the moving of modern vessels. Later designs, unhampered by property restrictions call for piers ranging from 120 to 300 ft. in width and slips varying from 200 to 300 ft. in width.

The open wharf is usually of the pier type, although occasionally its structural features are found in wharves lying along banks which for economy have not been confined by retaining walls.

New York Type

The New York type of open pier is composed of a wooden or concrete floor system resting on a substructure of wooden piles arranged in bents, the piles running up to the under side of the pier deck. The incline bents consist of a single row of piles on 5-ft. centers, and are spaced 10 ft. apart. The four outshore bents are each composed of two rows of piles on 2½-ft. centers and are spaced about 23 ft. apart. The fender system consists of oak fender piles driven at the end of each pile bent with fender capping and chocks to hold the piles in place. Perhaps the most distinctive feature has been the development of the concrete deck with asphalt wearing surface to replace the wooden deck and wearing surface ordinarily used elsewhere.

Cost figures were given by Charles W. Staniford, chief engineer of the Department of Docks and Ferries, in a paper presented to the American Society of Civil Engineers in 1913. The cost of the open pier, assuming the general dimensions to be the same, varies with the lengths of piles. For usual pile lengths it ranges for the single-bent portion of the pier from $1.23 to $1.60 per square foot and for the double-bent portion of the pier from $2.46 to $3.05 per square foot. These figures are for a pier with wooden deck and wearing surface and do not include the cost of any artificial bottom or pile kagging. In the latter about $18 a pile may be added, and $2.50 should also be added for each foot of fendering system. Mr. Staniford gives costs of 87 and 97 cents per square foot respectively with and without asphalt wearing surface. Because of the great sizes of the piers to which he refers the prices may be regarded as low for piers of usual dimensions, say from 60 to 100 ft. wide, and from 500 to 800 ft. long.

The New York open pier is admirably adapted to the natural conditions. Sewage pollution of the waters in the North and East Rivers and the upper Bay, practically permanent, has driven out wood borers, so that the pile substructures are permanent below mean tide. The tidal range averages about 5 ft. Therefore, as shown by severe fires, there is practically no fire risk in the pile substructures between mean water and the pier deck. Over the pier sites the water varies from 15 to 40 ft. in depth, generally too deep for an economical design of solid wharf or filled-in pier.

Philadelphia Construction

As at New York, Philadelphia wharves are usually open piers. Philadelphia, however, has sought to develop a type of pier that will be permanent from mean water up, yet having the cheapness of a wooden-pile subaqueous substructure. Transverse bents of two rows of piles are cut off approximately at 1½ ft. above low water. The bents are spaced 20 ft. center to center, longitudinally of the pier. The piles are clamped and capped, and this framing is covered with a light timber deck upon which are set concrete walls approximately 11 ft. high, these walls being in reality continuations of the pile bents to the pier deck. These cross walls support a system of steel floorbeams overlaid by a concrete deck or a system of reinforced-concrete floorbeams and slabs. On the concrete deck is laid pavement as a wearing surface.

Certain distinctive detail may be noted. The wearing surface of the deck is composed of 4-in. wooden-block pavement. The fendering system does not consist of the usual fender piles, but of fenders bolted directly into the ends of the concrete cross walls and the sides of the floor system. A peculiar feature of this pier is a substructure under the unshedded portion of the outer end of the pier. Extra piles are driven between the two outer bents, and the floor system on which the cross walls rest is extended over these piles so as to floor over entirely the open space between the bents. The cross walls on these outer bents are designed as retaining walls with returns along each side of the pier, thus entirely enclosing the floored-over area. The pocket thus made is filled with earth to the level of the pier deck, on which is laid a concrete slab with wearing surface, this making a very substantial outer end to the pier.

Recently the port authorities requested bids on several modifications of the above design, and also on a design calling for a pier 550 ft. long by 180 ft. wide. Bids ranged from $2.15 to $2.54 per square foot for the New York type, and from $2.23 to $3.07 per square foot for the more permanent designs.

San Francisco—All Concrete

The natural conditions at San Francisco are best met by the construction of the open pier all in concrete, substructure and superstructure. With a tidal range of only 4 ft. 3 in., the deep water close in shore to the established bulkhead line over the pier sites requires the open or pile type of substructure; and, on the other hand, with firm foundation reached from 40 to 75 ft. below sea level there is little apprehension of settlement so detrimental to concrete structures. The bay is so infested with the teredo that the life of the ordinary wooden pile is only from 6 to 12 months. Hence at San Francisco has been evolved a distinctive type of concrete pier. The characteristic feature is the use in some form of large reinforced-concrete cylinders or columns in place of the comparatively small reinforced-concrete pile used in the Baltimore wharf. These cylinders are from 3½ to 4 ft. in diameter, and with reinforcement permit of such concentration of the floor load that they are usually spaced on about 20-ft. centers in both directions. The floor systems were first steel I-beams for stringers and decking, and then steel framing encased in concrete with a reinforced concrete slab. For heavy traffic, vitrified brick has been used as a wearing surface.

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* Abstracted by the Engineering Record from a paper presented at a recent convention of the American Society of Port Authorities.

For cost data, it may be noted that the successful bidder for piers 30 and 32 in 1912 cited the following prices: For cylinders 3 ft. 10 in. in diameter, $3.15 per linear foot; cylinders 3 ft. 6 in. in diameter, $4.93 per linear foot; cylinders 4 ft. in diameter, $4.58 per linear foot. The Fort Mason piers are believed to have cost about $3.35 per square foot.

Portland Construction

Another interesting design of "open wharf" was prepared for the Portland (Oregon) Commission of Public Docks, but has not been followed as yet. The supports of this type of wharf are wooden piles driven in clusters cut off at low water, capped by a wooden and concrete grillage and surmounted by concrete columns or pedestals from low water to the deck level, these supports being centered on 10-ft. squares. This type was designed to meet extreme variations in water levels, where at seasons of low water some 30 ft. of the substructure might be exposed for several months in an extremely dry climate. The fire risk is thus obviated by the concrete columns from low water. On the other hand, the cheapness of subaqueous timber construction was secured by founding these columns on timber, piles being permanent here, since the teredo is absent.

Solid Wharves

In the solid wharf a retaining wall is built on the perimeter of the pier. The area within the retaining walls is then filled by dredging from the adjacent fairway or by fill dumped from the mainland. A usual type of retaining wall is designed as follows: A platform on piles, timber or concrete is constructed, the deck of which is near the level of low water. On this platform is built a retaining wall, sometimes a timber crib, frequently of concrete and masonry. The top of this retaining wall is at the level of the pier deck. The platform is wider than the bottom of the retaining wall, the extra width being to the rear of the wall and acting as a relieving platform. At the rear of the relieving platform sheet piling is driven with a sufficient penetration into the natural bottom. In this way a continuous retaining wall is formed to inclose the pier area, which is then filled in. This type of retaining wall is generally termed as a "relieving platform wall." Its cost varies with the design from $80 to $125 per linear foot. There are many modifications of this platform type of construction. In some cases the retaining wall is founded on piles, steadied by a riprap filling in the front, extending from the natural bottom to the under side of the retaining wall. Since this riprap continues the retaining wall to the natural bottom, sheet piling is unnecessary. Frequently in front of this type of wall a platform on piles is constructed at wharf level. This platform stiffens the wall and provides sufficient depth of water in front thereof for the wharfing of vessels. The cost of this wall is generally higher than the relieving type, running from $150 to $250 per linear foot, depending upon the amount of riprap filling.

Frequently where suitable bottom is reached at a reasonable depth a solid retaining wall is constructed, founded on the bottom and running up to the wharf level.

At Baltimore has been designed a unique type of retaining wall for a solid pier with moderate depth of water alongside. Steel cylinders, afterward filled with concrete, were driven around the outline of the pier, and spaced 25 ft. centre to centre. Between these cylinders continuous sheet piling was driven—the lower end with sufficient penetration to hold at the bottom, the upper ends retained by longitudinal steel and concrete girders running horizontally from cylinder to cylinder, on which they rested. These girders were held back against the sheet piling by tie rods, anchored in reinforced concrete piles inside the prism of thrust.

General Summary

Summing up, experience limits the construction of open wharves to widths not greater than 150 ft., usually from 60 to 100 ft. Beyond this width it soon becomes more economical, except under unusual conditions and great depth of water, to construct the solid type of wharf.

Where the teredo and limnoria are absent and moderate tides prevail and low first costs are desired, the New York pier is preferable. With the same natural conditions, but with a desire for permanency, the Philadelphia design is admirable. Where there is a great variation in water level, especially if seasonal, the Portland plans offer economy and minimum fire risk. With wood borers present and moderate tides and depth of water over firm bottom, Baltimore furnishes an excellent type. For great depths of water and higher tides, the San Francisco pier may well be adopted as a standard.

The employees of Siemens Brothers Dynamo Works have responded with great enthusiasm to the call to arms. A large number of men from their works and offices at Stafford, Eng., amounting in all to about four hundred, have already joined the forces, and, together with the reservists and volunteers from their head office, branch offices and other departments, the total amounts to some 520. The firm is arranging to keep the posts of all these men open, and ample provision is being made for all the dependents of those who have gone to serve.

Public Works Being Carried Out

The Dominion Government, notwithstanding the financial stringency, is carrying out its programme of works under construction. Up to the end of October the expenditure on ordinary and capital accounts exceeded by eight million dollars the expenditure on similar accounts last year.

Uniformity in Compiling and Reporting Statistics of Water Purification Plants

ABOUT a year ago a committee was appointed by the New England Water Works Association to consider the subject of "Statistics of Water Purification Plants," and to recommend certain standard forms for reporting such statistics. A progress report was made at the annual convention of the association held early in September of this year.

The committee divided the subject into five topics, namely, descriptive data, statistics of analysis, engineering statistics, financial statistics and vital statistics. Only the first two topics are covered in the progress report, and these, in only a preliminary way. A final report will probably be made at the next annual meeting. The progress report, with the statistical forms here mentioned, will be published in full in the Journal of the Association. The following excerpts from this report are of wide interest to all water-works engineers and operators.

Descriptive Data

The number of water purification plants in the United States today is very large, and during each year new plants are constructed. Descriptions of the most important plants have been published and may be found scattered through engineering papers, magazines, and official reports. When reading these, it is found that a number of important facts are omitted. So numerous are these omissions that it is impossible from the published descriptions to make compilations of even the most general data which will be adequate. Thinking that it would be of service to those preparing descriptions of filter plants for publication, the following schedule of desirable data has been prepared. Further details would be useful in many cases, but the following items in connection with the study of the operation of a purification plant are always important:

1. City or town, and population at last census. 2. Name of owner. 3. Name of designer. 4. Date when plant was put into service. 5. Total cost, with statement as to what is included. 6. Source of supply. 7. Rated capacity. 8. Method of purification. 9. Total capacity of subsiding or coagulating basins. 10. Total capacity of filtered water basin. 11. What chemicals are applied. 13. How applications of chemicals are applied. 15. Net area of filter surface. 16. Depths of filtering materials. 17. Sizes of filtering materials. 18. For slow filters—arrangements for cleaning sand surface, sand handling, sand washing. 19. For mechanical filters—method of cleaning filter beds. 20. Number of subsiding or coagulating basins. 21. How the rate of filtration is controlled.

Statistics of Analysis

Blanks illustrating the committee's recommendations regarding the form of report, the tests to be made and the method of expressing results, are incorporated in the preliminary report. These blanks are seven in number and are referred to as numbered tables. They give: Chemical and microscopical character, turbidity and color, and bacteria in raw water; also the chemical character, the turbidity and color, total bacteria, and number of B. Coli in the water delivered to mains. These tables are arranged to show the analytical data by months and years. The terms used in the tables are all fully explained.

Essential Determinations.—The elimination of unnecessary analytical work is a matter that needs consideration at this time. Laboratory practice at various purification plants has shown that many of the determinations which are ordinarily included in the standard water analysis schedule are here of little or no importance. For example, the determination of nitrogen in the usual forms of free and albuminoid ammonia, nitrites, and nitrates serves no particular purpose in water purification except in special cases. They neither assist the superintendent in the operation of the filter, nor give any adequate idea of the safety of the filtered water. On the other hand, some of the simpler physical tests, such as numerical determination of turbidity, color, and odor, microscopical examinations and tests for alkalinity, iron, and carbonic acid, have come to be regarded as most valuable; and in special cases various other tests, such as dissolved oxygen and manganese. Bacteriological tests are, of course, important.

Sample for Analysis.—One step in making an analysis of water has never received half the attention that it deserves, namely, sampling. Of what value is it to use analytical methods of great refinement if the samples themselves are not representative, if the mass of water from which the sample is taken is not homogeneous, or if the water changes in character from one day to another? Samples for chemical analysis are almost never larger than 1 gal., and samples for bacteriological analyses are seldom larger than 100 c. c., while the quantities actually used for the different tests are still smaller. In counting the number of bacteria, the quantity used is less than a thimblefull.

On the other hand, we know that bodies of water are not homogeneous. In a lake or settling basin there are vertical and lateral variations; a river is constantly changing, not only in volume but in the character of the water; filter effluents vary, especially the effluents from mechanical filters where the runs are short and the rates are high. The causes of these variations which affect the results of water analyses through unfair sampling are so numerous that they cannot be studied by themselves, and the only course left is to apply to them the laws of probability, or, in other words, to arrange the data secured in some such way that the importance of the inevitable variations may be indicated and an index of the character of the water examined be obtained.

Thus we see that a question of fundamental importance is that of frequency of collecting samples. The question is: How often must samples be taken to obtain reliable results? As a general proposition it may be stated that the frequency of sampling should depend upon the frequency of change in the character of the water examined. For a water of constant quality, a few samples taken at infrequent intervals may serve to give a fair idea of the water, but if a water be subject to great fluctuations in character, a few samples taken at long intervals might or might not give a fair idea of the water. The reliability of the average result will be determined by the laws of probability. The average result does not tell the whole story, for it eliminates the individual results, and a water supply should be safe and wholesome all of the time.

The frequency of sampling has a limitation, which is controlled by practical and financial considerations. In a small plant the cost of daily analyses would usually be prohibitive, and even weekly analyses might be a burden. It would be recognized, however, that results based on infrequent samples are less valuable than those based on frequent samples; and that irregular sampling gives the most unreliable results. In order to emphasize this point it seems desirable to establish certain grades of control of operation, based upon the character of the records kept, as follows:

First Grade: Water purification plants under first-grade supervision are those where analyses of the filtered water are made one or more times a day, and where engineering and such other data regarding the operation of the plant as are necessary are collected by one or more attendants constantly employed.

Second Grade: Water purification plants under second-grade supervision are those where analyses are made regularly, say once a week or once a month by a trained analyst, and where an attendant constantly on duty makes simple daily tests.

Third Grade: Filter plants under third-grade supervision are those where analyses are made irregularly and infrequently, and where no daily tests are made by the attendant.

This grouping should not be considered as necessarily casting a stigma upon second or third-grade supervision. Some water supplied may not demand first-grade records. In general it may be said that the safer the raw water, the lower may be the grade of analytical supervision. In other words, polluted waters require the purification plant to be operated with a higher factor of safety, and to this end a more careful analytical control is needed. Stored waters are safer than unstored waters, and with them a lower degree of analytical supervision may suffice. A corollary to this would be that small plants which cannot afford high-grade supervision of filters should endeavor to protect the quality of the supply by storage or by incorporating a large factor of safety in the design of the plant.

Efficiency of Operation.—No provision is made in these tables for recording the percentage of bacteria, a method that has been much used in the past. While this method has certain advantages, it is so susceptible to misuse that the committee recommends that it be omitted from official reports of filter operation. The reasons why the percentage removal method is unsatisfactory were discussed at some length by the committee. Eight reasons were assigned for abandoning the "percentage removal" method of gauging the efficiency of a filtration plant. The reasons follow:

(1) The bacteria found in the effluent are not all derived from the raw water. A certain and varying number of them represent growths in the lower part of the filter. The bacteria from this source do not vary in number with the number of bacteria in the raw water, but with the rate of filtration, with disturbances occasioned by the collection of air within the filter, and with other factors of operation.

(2) It requires a certain time for the water to pass from the point where the raw water sample is taken to the point where the filtered-water sample is taken. Sometimes this amounts to several hours, and in the case of a water which changes rapidly in quality and character it is necessary to make an allowance for this time if a correct comparison is to be obtained. As a matter of convenience it is common to collect samples of the raw and filtered water at about the same time. Hence there may be an error due to this difference in phase. Whether or not this is of importance depends upon the uniformity in the character of the raw water.

(3) The percentage removal is to a certain extent a function of the number of bacteria in the raw water. It is a well-known fact that the percentage removal of bacteria is relatively high when the raw water contains large numbers of bacteria and relatively low when the raw water contains few bacteria.

(4) The percentage removed does not necessarily vary with the number of bacteria left in the filtered water. The following is an example:

Day	Nos. of bacteria. Raw water.	 Filter effluent.	Percentage removed.
First..	50	3	90.4
Second	1,000	10	99.0
Third	600	20	96.6
Average	555	11	

It will be noted that on the day when the number of bacteria in the effluent was lowest, the efficiency as shown by the percentage removal was also lowest.

(5) The infectiousness of a water does not necessarily vary with the number of bacteria in the water, but in most waters there will doubtless be some connection between the two.

A water polluted with surface wash would doubtless increase the infectiousness, and the numbers of bacteria would increase with increase stream flow. On the other hand, a water regularly polluted with sewage, other things being equal, would increase in infectiousness as stream flow decreased, that is, as dilution became less, while the numbers of bacteria under these conditions might decrease. Hence, there seems to be no very definite relation between the infectiousness of a filtered water and the percentage removed of bacteria by a purification plant, which percentage varies according to the numbers of bacteria in the raw water.

(6) If any comparison is to be made between the numbers of bacteria in the raw and filtered waters it would be better to use the "percentage of bacteria remaining," partly because the numbers themselves are smaller and easier to handle, and partly because the figures show to better advantage the variations in the operation of the filter; for example, when two filters, with the same raw water, are operating so as to produce 98 and 99 per cent. "removals" of bacteria, respectively, the numbers of bacteria remaining in the effluent of the first will be twice as many as in the effluent of the second. Again, comparing one filter with an efficiency of 99 per cent. with another filter with an efficiency of 99.9 per cent, both operating with the same raw water, the difference at first sight seems small, yet the effluent of the first of these filters contains ten times as many bacteria as the effluent of the second. Hence, the method of stating efficiency of a filter plant in terms of "bacterial removal" may be misleading.

(7) A single figure showing the percentage removal of bacteria during a certain time—as, for example, a month—gives no idea of the regularity of operation of the filter during this period.

(8) A common fault of filter specifications is the provision that the plant shall show a certain percentage removal of bacteria when the numbers of bacteria in the raw water are below a certain limit. This specification is inadequate. A good water purification plant is one which produces a satisfactory effluent every day of the year and every hour of the day; and, if efficiency can be expressed on a percentage basis, it should be indicated by the percentage of the time during which the plant produced a good effluent, rather than by the percentage comparison of bacteria in influent and effluent respectively.—Engineering and Contracting.

Paving Floors Like City Streets

THE ideal shop floor is that one which has sufficient durability to withstand the required service and at the same time tends to increase shop efficiency and decrease labor costs.

Just as city engineers have sought a street paving material which would require a minimum of repairs, so have shop managers been always on the look-out for a durable floor which would successfully withstand hard service, prove as easy under foot, be smooth, have a low tractive resistance, be dustless and sanitary and which could be easily taken up and replaced for necessary repairs to underlying pipe and conduit:

Shop floors have been very generally experimented with in an endeavor to find materials which fulfill these conditions imposed by hard service. Machine shops are especially hard on flooring material.

A modern factory floor should meet the following requirements:

It must be resilient and untiring to the workmen. To accomplish their work, men must be comfortable. Where work requires more or less constant standing, the floor for ideal conditions should not be cold, hard or damp.

It must be smooth and have a low tractive resistance so that trucking costs may be low.

It must be durable, thus eliminating the necessity of frequent and costly renewals.

It must be constructed of a material which is a poor conductor of heat.

It must be dustless. Floors which disintegrate or pulverize into grit and dust are harmful to the bearings of machines.

It must be sanitary.

It must be hard but resilient.

It must be noiseless.

It must be impervious to the effect of acids and oils as well as to moisture.

Practically all floor materials meet one or more of these requirements. That floor is best which conforms to the greatest number.

Many managers have watched the success which has followed the use of wood blocks in paving city streets and have used this material for their factory floors. When treated with creosote they are not subjected to the rapid decay which, under some conditions, affects untreated wood blocks or planks.

As the blocks are laid with the grain up they present a surface like the face of a mallet and so wear smoothly and uniformly even under heavy trucking Since wood is a poor conductor of heat, there are no complaints from the workmen of cold and hard floors as is frequently the case where other materials are used for the purpose.

Floors of wood block do not disintegrate or pulverize into grit which injure the bearings of machines and where impregnated with creosote oil they have an antiseptic property which adds to their value from a sanitary point of view and further makes them free from the action of acids and oils and impervious to moisture. Floors of this material have the same advantages of noiselessness that wooden paved streets enjoy.

Sharp edged tools are continually being dropped on factory floors and in this way are often dulled and broken. Such is not the case with wood block flooring because of its resiliency.

Factories which use the wood block flooring find that it has advantages when it is necessary temporarily to take up a portion of the floor in order to make repairs to underlying portions of the structure.

The ideal method of laying a wood block floor is to provide room for any possible expansion between each block. Specifications often call for a quarter inch space left between the ends of each block to take care of this expansion element, but in actual practice it is often difficult to enforce its compliance.

Specification for Sand in Reinforced Concrete

IT is generally acknowledged that the specifications most frequently used for sand are inadequate in that they are too brief or too indefinite to secure the desired results. Recent specifications have overcome these defects in some respects, but most of them are objectionable in that they are too inflexible, i.e., fail to allow variations in the quality of the sand to meet varying conditions or different requirements, or else by placing undue stress on some particular requirement bar from use sands which would prove entirely satisfactory. The following specification is given in Bulletin No. 67 of the University of Illinois and has been prepared with the idea of giving the necessary flexibility and general guidance in drawing up the specification for any particular piece of work.

Definition of Sand and Screenings.—The term "sand" shall be understood to mean natural sand which will pass, when dry, a screen having ¼-in. clear openings. Similar material which is the product of artificial crushing shall be known as "screenings," and shall conform to the specification for sand.

Specification for Sand

Composition.—The sand shall consist of grains from hard, tough, durable rocks, and be free from soft, decayed, or friable material.

Cleanness.—The sand must be free from lumps of clay, loam, or other foreign material. It shall not contain more than 2 per cent. by weight of finely divided clay, loam, or other suspended matter when tested by washing in such a manner as to remove all such material without removing any of the finest sand; provided that if the strength of the mortar made from the sand is greater than 110 per cent. of the strength of a similar mortar made with standard Ottawa sand, the amount of suspended matter may reach 3 per cent. This suspended matter must not form a coating around the grains to such an extent that such coating is not entirely broken up and removed from the grains by sprinkling with water or in the mixing of the mortar or concrete. The sand shall be free from oily or greasy matter in any form and must contain no organic silt.

Roughness—The grains shall have rough, unpolished surfaces to which the cement paste will readily adhere.

Size of Grains.—The grains shall be well graded in size from the finest to the coarsest. For the greatest density not more than 8 per cent. by weight, including the suspended matter, shall pass the No. 100 sieve, and not more than 60 per cent. the No. 16 sieve. If maximum density is not essential and the mortar yields the required strength, these quantities may be increased to 12 per cent. and 75 per cent., respectively.

Voids.—The voids in the dry sand, when well shaken, shall not exceed 33 per cent. of the total volume of the sand.

Tensile Strength.—Mortar, in the proportions of 1:3 by weight, when tested at an age of 28 days, shall develop a tensile strength at least equal to the strength of a similar mortar made of the same cement and standard Ottawa sand tested at the same age.—Ferro-Concrete.

Data Relating to Wear and Cost of Concrete Roads With Details of Maintenance Expense

By W. S. Shaw

ENGINEERS over the entire country are realizing that a concrete pavement made of carefully selected aggregates, properly proportioned, mixed, and placed offers a solution for many paving problems, and is a method of construction possessing inherent merits well worthy of investigation. As a result of a number of years of experiment during which time many methods of construction were tried out general practice has narrowed down to two types, known as the one and two course pavement, with the one course paving meeting general favor. While concrete has been a comparatively modern paving material, still we have authentic record of paving laid at Bellefontaine, Ohio, in 1893-94. This pavement was laid in two courses very similar to the present day method of laying sidewalks, the entire pavement being divided into 5-foot squares. After twenty years' wear the pavement is in excellent condition except the longitudinal joints between many of the squares. These have worn away considerably, but even at that the total cost of maintenance on four city blocks around the Court House, subject to the traffic of a town of 6,000 to 8,000 inhabitants, in twenty years has been less than $300. Had longitudinal joints not been used, and the best modern methods of paving do not countenance their use, this Bellefontaine pavement would be in first class condition to-day.

Owing to the smooth uniform surface which sheds water very rapidly, it is possible to construct these pavements with a very low crown, eliminating the slipping and skidding which accompany any high crowned road and distributing the traffic over the entire surface of the pavement; for it is a noticeable fact that on any high crowned road the tendency of traffic is naturally to use the crown, thereby concentrating the main part of the traffic in two narrow ruts which cause the centre of a macadam road to give way leaving the sides practically untouched, a very serious drawback to a high crown road construction, yet an insurmountable one with macadam or gravel.

While the specifications for this work may vary a little in various localities, due to local conditions, still in general the following methods if carefully followed will produce good results in any locality. In brief, the paving should be constructed of a 1:2:3 mix, the coarse aggregate to be retained on a ¼-inch and pass through 1½-inch screen. The fine aggregate should not only be clean and free from loam, but must be well graded and of sufficient hardness and toughness to resist abrasion and the effect of the steel tired traffic. The slab should have a minimum thickness of six inches with a crown of not less than 1/100 of the width of the road and not more than 1/75. Expansion joints should be placed three or four every hundred feet, and where the paving is 20 feet or over it should be reinforced.

Too great care cannot be exercised in selecting proper aggregate. Wherever possible to do so it will more than repay engineers to have the aggregates they propose using tested in order to ascertain definitely their quality.

The first step in constructing a hard surface pavement is the preparation of the subgrade or base, really the foundation of the road. This subgrade should be reduced to the desired level and thoroughly rolled so as to produce a firm, hard, uniform surface. Any soft spots should be eliminated, if necessary dug out and filled with stone or other hard material and the surface sealed with some fine material so as not to permit mortar from the concrete to seep into the stone filler.

The question of draining the subgrade is a problem which varies considerably in different localities, but the ultimate results desired are a drainage system which will keep the subgrade at all times well drained to eliminate settlement or washouts and heaving from frost action. Very often the fact that a subgrade is rolled harder in the centre than at the sides will be sufficient cause for settlement.

The method that has been generally adopted for eliminating these cracks is to place expansion joints every 25 or 30 feet across the pavement, cutting entirely through the slab and filled with some plastic and resilient material which will stand the wear and tear of traffic and weather, such as tar asphalt or asphaltic felt. The great trouble with these fillers is that they do not protect the sharp edge of the concrete slab. This has led to the adoption of armored joints; the armor consisting of two thin sheets of steel bent to conform to the crown of the road with members sheared out at intervals and bent back to bond into the concrete. These joints are clamped together with a filler between them of tar paper or felt, and when properly placed the results are excellent. The frictional resistance offered by a rough base to the movement of expansion and contraction is more likely to have a serious effect on the slab than if the base were smooth. For this reason a flat, rather than a crowned, subgrade is recommended.

After the subgrade is ready and forms, preferably steel, have been placed to grade, the concrete which has been mixed in a batch mixer to a mushy consistency is placed on the freshly dampened base. This concrete is then struck off with a template, its striking surface being faced with steel and the extreme ends resting on the side forms. This operation reduces the concrete to a roughly finished grade, which is then floated by finishers working from a bridge. On ordinary grades the coarse aggregate is worked under the surface of the mortar and the finish left on the road is the ordinary texture of the mortar itself, a smooth trowelled finish similar to that on a sidewalk not being desired or required. A steel trowel should never be used. On heavy grades, say from 8 to 18 per cent., some artificial roughness may be provided if desired.

After the concrete has hardened sufficiently it should be covered with loam or sand to a depth of a couple of inches, and then kept thoroughly moistened for a period of 10 to 14 days, depending on climatic conditions. While in some instances it has been considered feasible to turn traffic on a newly laid pavement fifteen days after it is laid, it is a mistaken policy to use a newly laid road befort thirty days.

Wayne County, Michigan, has constructed since 1909 about eighty miles of concrete highway, built almost entirely by day labor under personal supervision of the county commissioners. The aggregates were shipped a distance of about 100 miles, and their pavement cost them from $1.04 to $1.74 per square yard including excavating and drainage, an average cost of $1.27. The maintenance on these roads has been less than $28.00 per mile per year, an extremely low figure to keep the surface of any road in condition.

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* Paper presented before the [illegible] of Pennsylvania.

Mason City, Iowa, in 1909-10, laid 30,000 square yards of concrete paving with a maximum thickness of 7 inches in the slab at cost of $1.26 per square yard. There has been no maintenance on this to date.

The State of Maryland has laid a number of miles of concrete highways in the last two years. These roads have been laid over treacherous clay subsoils; through marshes along the eastern shore, and have come through these tests most successfully. The pavement which has already been laid in that state has cost from $0.98 to $1.35 per square yard, exclusive of drainage, and the maintenance up to date has been practically nothing.

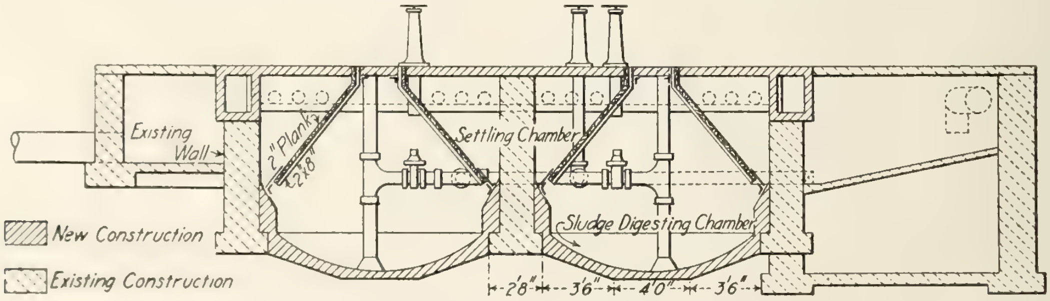
At the National Conference on Concrete Road Building in session at Chicago, 1914, a committee reported that the average cost of concrete pavements and highways in forty-two states was $1.24 a square yard, exclusive of drainage and excavation, as authentic figures on this part of the work were not available.

Remodelling a Septic Tank and Contact Filter Sewage Plant

By Alexander Potter, Consulting Engineer, New York

By changing old septic tanks into two-storey Imhoff tanks and converting existing contact beds into sprinkling filters the sewage treatment plant at Moorestown, N.J., built in 1901 to treat 250,000 gal. daily, has been remodelled to handle a daily flow of 500,000 gals.

From a grit chamber sewage entered an open brick septic tank 75 ft. long, 25 ft. 6 ins. wide, with an average depth of 1 ft. Two 20-in. brick walls divided it into four equal compartments arranged so that two, three or four of the chambers could be used at any one time.



Cross-section showing old work and modifications.

The contact bed was divided into four units, each 85 ft. x 42 ft., area, each inclosed by 16-in. brick walls. Three of the beds were filled to a depth of 4 ft. with slag ranging in size from ¾ to 1½ ins.; the fourth bed was filled with cinders.

The work of remodelling consisted in removing the existing bottom and excavating to an additional depth of 2 ft. 4 ins. As the new bottom was carried below the foundation walls of the old tank it was built in the form of an arch to give the necessary stability to the walls and to assist in the removal of the sludge. In the old septic tank the level of the liquid was maintained at El. 15. In the remodelled tank this was raised to El. 15.5, necessitating the raising of the outside walls a height of 6 ins. These changes increased the depth of the tank from 7 ft. to 9.5 ft.

The remodelled tank consists of four units each of which is again divided into three compartments by a false bottom constructed of 2-in. creosoted yellow-pine. This false bottom makes a slope of 40 deg. with the vertical. The upper two compartments are settling compartments and the lower and larger compartment is the sludge digestion compartment. The total settling capacity amounts to a retention of 1.35 hours when the plant is operated at the rate of 500,000 gals. daily. The total capacity of the sludge digestion chamber figured below the level of the walls is 5,470 cu. ft., about 50 per cent. larger than required by established practice. Three 6-in. sludge pipes extend down into the sludge digestion chamber of each unit.

Cost of Remodelling

The cost of remodelling the plant and enlarging it 50 per cent. to adapt it to the present flow was as follows:

Cost of Remodelling Plant

Remodelling septic tank into two-storey tank	$3,100
Construction of dosing tank, siphon and piping	1,800
Sprinkling filter, ¼ acre	8,300
Sludge bed and piping	300
Additional piping around plant	1,300
Final settling basin	500
Total	$15,300

The cost of remodelling the contact beds into a sprinkling filter was somewhat more than was expected as it was found that less than 10 per cent. of the filter medium of the original beds could be used in the new filter.—**Engineering Record.**

Unusual activity in the manufacture of barbed wire is reported by Canadian steel mills. Large orders are coming in from the allied armies and nearly every plant is working to capacity. It is said that in some cases orders running into thousands of tons have had to be refused owing to the impossibility of making delivery.

The Effect of Leaking Illuminating Gas on Bituminous Pavements

By George G. Warren

TO everyone who has had long experience in bituminous pavement construction and maintenance it is well known that illuminating gas escaping from subsurface gas mains is very injurious to all forms of bituminous pavements, and yet we frequently find representatives of gas companies and city officials ridiculing the idea that gas can have any effect on such pavement surfaces.

The fact is that illuminating gas, a bituminous substance, and hydro-carbon, quite similar in its chemical composition to light tar and oil distillates, is lighter and more penetrating than the distillates and even more rapidly attacks and liquefies a bituminous cement, no matter whether the bitumen be a tar or an asphaltic product.

In my thirty years of experience with asphalt and other bituminous pavement construction this matter has come up many times, and generally the persistent claim of the gas companies is:

1. That it is ridiculous to suppose that gas will attack an asphalt pavement.

2. That the gas mains have been carefully tested by plugging holes through the pavement and into the ground and that there are no leaks.

3. When the main is on the side of the street opposite a portion of the street affected, it is too far away.

I would comment on these points as follows:

1. There can be no question but that coal gas, being a hydro-carbon in gaseous, and therefore its most penetrating form, will attack any form of bitumen even more rapidly than oil, just as gasoline, being more penetrating, will attack bitumen more rapidly than heavier oil, such as machine oil, for instance.

I particularly remember one extremely aggravated case on West End Avenue, New York City, about fifteen years ago, which became reaffected, and the asphalt pavement again ruined within three months after it was resurfaced, the gas company having claimed that they had thoroughly tested the mains and repaired the leaks. Shortly, subsequent to this, the gas company was obliged to entirely relay the gas main and the pavement was again relaid.

2. Even if they dislike to, or will not admit it, the gas companies well know that the "plugging" test only sometimes locates the leaks. They naturally dislike to go to the expense of tearing up and relaying pavements and excavating to and uncovering the mains unless the conditions become such that they are absolutely required to do so.

3. The leaking gas naturally follows the lines of least resistance, which may be in either a nearly vertical line and show the result almost immediately above the leak, or, what is extremely hard to find, may follow a long distance through a vein of porous earth or along the space formed by some old settled trench and reach the pavement surface a long distance from the leak. In such case the pavement is generally affected over a large area, because the earth has become quite generally saturated with the gas, which gradually works up to the pavement surface.

I remember a case in about 1888, on Rutger Street, Utica, N.Y., where the first indication of trouble in the gas main was the effect on the asphalt pavement. The gas company claimed they had repaired the leak and a considerable area of pavement was relaid. About a month later an elderly couple, while asleep in one of the residences nearly a block away, was nearly asphyxiated by gas leaking from the street. Probably the gas had first found a partial outlet, following along a vacancy in some trench settlement, and then through the pavement. Subsequently the leak became worse, with the serious result referred to above.

Frequently, if not generally, the first indication of leak in the gas main where the street has a bituminous pavement is the effect on the pavement, in which case it is good fortune that the pavement is of a character which is affected by gas and will permit the gas to permeate the surface, thus lessening the chance of serious casualty as above outlined in Utica.

The visible effect of leaking gas on a bituminous pavement is a serious "shifting" or "rolling" of the pavement in its softened condition, accompanied by a breaking up of the surface into a "crackled" appearance not unlike the folds or cracks in an alligator's back.

Generally, when this condition is noticed, a perceptible odor of gas will be found in the pavement surface, but sometimes the leak may have been repaired or the gas taken another course and the gas escaped so that its odor cannot be detected, yet the pavement is left in a seriously damaged condition. On the other hand, under certain subsoil conditions, the earth below the pavement may retain the escaped gas and continue to have its damaging effect for months, if not years, after the gas main has been repaired and the cause of the trouble probably removed.

The effect on the pavement may extend for a considerable period beyond the repairs to the gas main unless steps are taken to provide frequent vents, left open for several days, if not weeks, after repairs to the gas mains are made.

In such cases, before making repairs to the pavement, its entire surface over the main and where the surface shows the effect of gas should be removed and the gas main should be thoroughly repaired(renewed if necessary). After the leaks are repaired vents or openings at least 1 ft. square, extending from the surface to the level of the gas main, should be left open for two or three weeks or longer, if there is still any odor of gas, and the openings then refilled and thoroughly tamped and the pavement surface relaid. With this precaution the trouble will probably be overcome if the gas company has not been too parsimonious, inefficient or incomplete in making of repairs to the gas mains.

In conclusion it may be well to call attention to a primitive but quite general custom of the gas companies in their "hunt" for leaks. I refer to the custom of having two or three men, one of them selected for his "smelling" efficiency, go along the street where there are indications of gas leaks, hammering a com-

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Abstracted by Engineering and Contracting from a paper before the American Society of Municipal Improvements.

[illegible] far through the pavement into the ground below. These holes are made at intervals of a few feet. The "smeller" man puts his nose to the holes, and if he discovers a sufficient odor of gas to attract his attention an opening is dug to try to discover the leak. If the "smell" test does not locate a leak apparently below the hole it is quietly filled with dirt. A few weeks later the city official, or the "poor devil" of a paving contractor, if he happens to have the pavement under "guaranty," finds serious holes along the centre line of the pavement and, not being able to trace the trouble to any cause, he makes the repair, if his "guaranty" is good, or "lets it slide" if he and his "guaranty" are no good, and perhaps at the end of a lawsuit the city makes the repairs.

The simple, but so far as the writer knows never enacted, cure for this evil is an ordinance requiring gas companies, whenever they want to test their mains, to cut openings of sufficient size through the pavement to enable excavation to the gas main, absolutely prohibiting the promiscuous drilling holes through the pavement as above described, and to pay for making a proper repair to the pavement. With the enactment and enforcement of such ordinances the chances of locating the leaks are greatly increased and the unfairness to the city and contractor of making holes in the pavement without adequately repairing them will be eliminated.

A paper read before the Institution of Electrical Engineers some time ago deals with the fundamental laws governing electrolytic corrosion of iron in soils. Experimental data are given showing the effect of the different factors that are most likely to influence electrolytic corrosion of buried pipes under practical conditions, such as current density of discharge, moisture content of the soil, presence of oxygen, temperature, voltage, and other factors. The effects of earth resistance, polarization, and surface film resistances are also discussed briefly, and tables are given showing the results of specific resistance and corrosion tests on a large number of soils taken from widely scattered sources, which give an idea of the order of magnitude of the values of resistance and corrosion efficiency that may be expected under average practical conditions. A number of conclusions are presented showing briefly the effect of the different variables involved and their relation to some practical aspects of the subject of electrolysis.

As several of our office force often have occasion to be away, sometimes for several days during each week, it became necessary to provide a plan whereby the regular office correspondence can be reviewed on the return to the office of any of the force, writes a Boston correspondent. This is especially important in our line of work for many times a letter will demand an immediate temporary reply, while the person to whom it is directed may be absent. On his return, the details must be taken up with as little delay as possible. To meet this condition we provided two daily files in the form of expansible folders with alphabetical indexes. One of these files is used as a temporary file during absence of any of the office force. On his return, it is but a simple matter quickly to review all correspondence while the plan offers a very simple method of readily locating letters which may be needed before filing in our standard drawer files. As soon as letters have been reviewed, the daily file is properly dated as well as checked and correspondence then filed in usual drawers. By having two of these expansible folders, one is always available for delayed correspondence, while the other is in use as a holder for daily letters.

Slag Macadam for Road Paving

In London, Eng., experiments have been made in the use of tar slag macadam in several streets. The following report of the results as observed thus far is given by Municipal Engineering:

In St. Marylebone the material was laid in two coats and rolled, the surface being covered with fine granite chippings, and the total thickness when finished being 4½ inches. The price varied from 4s. to 4s. 8d. ($1 to $1.15) per yard super, and the paving is said to be wearing well.

The New Eltham and Sidcup road, trial length, was laid down in July, 1911, by the Kent County Council by arrangement with the road board. The material used was blast furnace slag ranging from 2¼ inches down to ¾ of an inch. When laid in one coat of mixed gages, the proportions are about 60 per cent. ranging from 2¼ inches down to 1¼ inches, 30 per cent. from 1¼ inches down to ¾ inch, 10 per cent. from ¾ inch down to ½ inch. The binder used is distilled tar, without any admixture of other material, and after first setting it is not affected by normal changes of temperature. The cost per yard super. was 3s. 3d. as paid to contractors, and the paving has stood well and is said to be satisfactory. Another section, 794½ super. yards, on the same road, laid with the same material, is also satisfactorily reported upon. The road board says:

"This section is quite good, and shows comparatively little wear. The roadway on both sides of this section is properly curbed and channeled; and has properly constructed footpaths. These abutments give considerable support to the material forming the carriageway, preventing lateral thrust, and enabling better initial consolidation."

In the borough of Wandsworth on the Portsmouth road, trial lengths were laid for the express purpose of making comparisons between the rates of wear of previously treated tarred granite when compared with similarly treated tarred slag macadam. A section of the latter—1,629.16 super. yards—was completed in August, 1911, coated slag being spread in two layers, first layer graded from 2½ inches down to 1½ inches, second layer from 1½ inches to ½ inch, surface finished with fine chippings. The cost per yard super. was 4s. ($1). The condition of this section is said to be good, and the surface wearing uniformly.

The New York State Highway Commission last year laid some sample slag pavements, some report of which is made by Division Engineer F. S. Strong in the official organ of the commission, from which the following is derived:

The types in which the use of slag is allowed include plain concrete pavements, concrete pavements with bituminous surfacing, Hassam concrete pavements, water-bound slag macadam with and without glutrin, some with limestone screenings and some with slag screenings, and bituminous-bound slag macadam highways. Much of this work is now under contract, and a considerable portion of it will be completed this year. The material is also being used to some little extent as a surfacing material in the repairing of old macadam pavements.

It is believed that the careful and continuous future inspection of the highways built of slag will produce valuable information and statistics of its merits as a road metal.

A big bulk of the slag available in the section of the state referred to consists of blast furnace slag. However, in the further reduction of pig iron in the production of steel, various processes are used, as, for instance, in the open-hearth furnace, where the crude metal is further purified, here again a flux is used which rises to the surface of the molten mass as slag. Slag formed in this operation has been used but very little on account of the small quantities available for highway purposes, although it possesses many desirable qualities, such as hardness, toughness and excellent cementing qualities.

In the vicinity of Youngstown, Ohio, in 1909, the office of public roads, in co-operation with the Carnegie Steel Company, conducted a series of experiments to determine the best method of utilizing this slag for road construction. In the experiments at this place, the blast furnace slag was taken from a bank that had aged about two years, the material of which came from six blast furnaces of the same type. A steam shovel was used to load the slag from the bank into large gondola cars. These cars were drawn to a gravity screen, where the slag was dumped into a chute and pased over the screen to separate into proper sizes. After passing over this screen, it was taken by rail to a site about 1½ miles from the road upon which it was to be used, unloaded and hauled to the road.

These experiments, as shown by the bulletins issued by the office of public roads, proved very interesting, and demonstrate that there is a field for blast furnace slag in the construction of highways, and the results were so favorable that the various counties and the State Highway Department of Ohio have adopted standard specifications for the use of this material. Various reports of inspections made of these roads show that they have stood up well, and, owing to the cheapness in the first cost of this material and the lightness in weight, the investment in a slag furnace macadam pavement from an economic standpoint would seem to compare favorably with that of a stone macadam pavement.

Since the completion of these experiments, which were conducted with slag which was not run through a crusher, but was taken directly from bank and screened, slag pavements have been constructed from commercial blast furnace slag, the slag being carefully sorted to obtain the best materials and run through a regular stone crusher in order to obtain the proper sizes for use in the various courses of macadam, resulting in superior types of construction and more uniform and lasting types of pavements.

In the vicinity of Buffalo, where there are many large blast furnaces, this slag has been used to some little extent for highway work, although no intelligent effort was made to obtain a high-class construction, due to the lack of available money for said purposes in the localities where the work was done. Yet this material is found to consolidate under traffic without rolling, harden and smooth out, making an excellent country road. Where incisions were made in some of these roads for various purposes, it was found almost as difficult to cut through this material as to cut through a concrete foundation for brick pavement.

At the beginning of 1913 a plant was established in connection with the [illegible] to take over the slag product of these blast furnaces and produce therefrom a commercial product to be known as crushed screened slag for railroad ballasting and highway surfacing purposes. During the season of 1913 a considerable amount of this material was used on town highways, and reports received from various town and county superintendents in districts where this material was used stated that satisfactory results were obtained, although thus far it is too early to reach any conclusion as to the definite wearing qualities of this material.

In reference to the use of slag product in the open-hearth process in the manufacture of steel, perhaps some of the most successful work of this kind in the construction of streets or highways is that which has been done in the city of Cortland. In this city the first slag street was constructed ten years ago as a water-bound macadam highway, and, according to the city authorities, has given excellent results ever since. They also have other water-bound slag roads which have been built eight years with practically no repairs of any nature. During the last four or five years the city authorities have used a bituminous or asphaltic binder in the construction of the slag streets, using the penetration method with excellent results. The slag after being cooled is crushed in an ordinary stone crusher, the larger pieces being used in the bottom course, which is bound with loam. For the body of the top course, a slag varying in sizes from ¾ inch up to 2 inches is used. This top course has a finished depth of 3 inches, and is bound with a gallon to a gallon and a half of asphaltic binder to the square yard; is then filled with slag screenings and rolled. These streets have also the appearance of sheet asphalt pavements and are standing up well under fairly heavy traffic.

The authorities of the Toronto Observatory have been seeking an eligible site whereon to mount the giant reflector of 72-in. aperture now in course of construction. After much examination a suitable station has been found on a small hill 732 ft. high, about seven miles from Victoria. For air transparency the situation is admittedly inferior to the Lick Observatory, but it possesses some compensating advantages. The Government of British Columbia will assist the enterprise to the extent of purchasing the land—50 acres—and constructing a road to the top of the hill. The disc of the mirror is reported to be ready for shipment, and the constructors hope to erect the telescope next year.

A tunnel 14 miles long through the Caucasus Mountains has been proposed by a Russian committee. Through this tunnel, which will have great strategical value, the railroad between Waldikawkas and Tiflis will be shortened about 90 miles. The distance along the railroad is now 720 miles. The report states that the geological conditions are very favorable and that obstacles like those encountered at the Simplon tunnel are not to be expected. The temperature in the tunnel can be kept at 75 deg. Fahr. As the elevation of the tunnel is between 4,500 and 5,000 ft. above sea level no large subterranean flows of water will be encountered. From a geological point of view no reasons prevail why changes should be made in the proposed route. The work is estimated to require ten years to complete.

The proper amount of water to be used in mixing concrete is that amount which will produce a mixture of the specified consistency. The consistency of the mixture should be carefully watched and not the flow of water.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

Damage estimated at $10,000 was caused by a fire which occurred in the auditorium of a new $50,000 theatre at Brockville, Ont.

The Hamilton City Council has decided to submit a by-law authorizing the raising of $650,000 for laying storm overflow sewers.

At Chatham, Ont., a mill, dry kilns and boiler house belonging to the Sutherland Innes Company, have been destroyed by fire. The extent of the loss is not known.

The Hawkesbury Board and Paper Mills have in contemplation the construction of a paper and board mill at Hawkesbury, Ont. It is not anticipated that the erection of the building will take place this year.

At Halifax, N.S., a business block on the corner of Burlington, Argyle and Sackville streets, has been destroyed by fire. The stone front is reported to have been destroyed and the loss is estimated at $125,000.

Essex Motor Cycle & Machine Company, Limited, has been incorporated with head office at Essex, Ont., and a capital of $100,000. The new company will engage in the manufacture of motors and motor cycles.

The new drill hall in course of construction on St. Louis Street, Quebec, for the Dominion Government, is nearing completion. The building is stone construction and will cost about $150,000. Mr. D. Ewart, Ottawa, is the architect.

The parish of St. Anne de la Pocatiere, Que., is erecting a college of stone, terra cotta and reinforced concrete construction, at a cost of $400,000. Already the walls have been erected and work is being pushed as rapidly as possible.

The plant of the Canadian Metal Products, Limited, Guelph, Ont., is at present working at capacity. The company are said to have secured a share of the present boom in that line of business and the prospects for a good year are very bright.

A report comes from Windsor, Ont., that government contracts aggregating about half a million dollars have been closed with manufacturers of Windsor, Walkerville and Sandwich for war supplies, including automobiles, ammunition, motor trucks, etc.

The first definite proposition for the erection of houses under the new Housing Law, has been made to the St. John, N.B., City Council by Mr. Arthur H. Likely, who owns a large building tract at East St. John. He proposes to organize a company to build 500 workmen's houses.

At St. John, N.B., the new post office which the Dominion Government is erecting on Prince William Street at a cost of $500,000, is rapidly nearing completion. Mr. G. E. Fairweather, St. John, is the architect, and Messrs. Rhodes Curry Company, Amherst, N. S., are the general contractors.

A Machinery Hall, estimated to cost $145,000, is to be erected at the Exhibition Grounds, Toronto, according to plans prepared by Mr. G. W. Gouinlock. The building is to be of concrete, steel and brick construction. Tenders are to be called shortly with a view to starting the work this fall.

The Gilson Manufacturing Company, Limited, Guelph, Ont., has received an order for several hundred gasoline engines. These engines, ranging from 2 to 8 h.p., will be used for operating concrete mixers, hoists, etc. The order is said to have been obtained from the largest manufacturers of concrete machinery in the world.

The International Engineering Works, Toronto, have been awarded the contract for four Continental type Robb Scotch boilers of 250 h.p., for installation in connection with the filtration plant extension at Toronto Island, the general contractors for which are the John ver Mehr Engineering Company and Wm. Cowlin & Sons, both of Toronto.

At Toronto, Ont., the Advisory Industrial Committee has passed an appropriation of $25,000 to be used for the purchase of engines, generators and other machinery in connection with the equipment of the new Technical School. A request will be made to the Board of Control for the necessary funds and it is said that the purchase of Canadian-made machinery will be effected as far as possible.

One of the most extensive jobs being carried out in Montreal is the construction of underground conduits in the down-town section of the city. The work is being hurried forward by Mr. G. M. Gest, the contractor for the city. The laying of the lighting, power and other cables and the connection of these with the various offices, stores, and houses will be made next spring.

The Department of Railways and Canals and the municipalities which use the Welland Canal as a source of water supply have entered into an agreement by which the government proposes to construct a pipe line from Lake Erie to supply reservoirs of towns. The offer of the municipalities of St. Catharines, Welland, Thorald and Merritton to pay jointly an annual rental of $10,000 per year for thirty years, has been accepted. The work, which will cost over a million dollars, will be undertaken by the Government.

At Hamilton, work is in progress on a soap factory, estimated to cost $1,000,000, for Messrs. Proctor & Gamble Company. The buildings are to be of reinforced concrete, hol- Hamilton has been awarded to Messrs. Stone & Webster Company, of Boston. Contracts for the steel work were awarded some time ago to the Hamilton Bridge Company. It is said that all sub-contracts will be awarded in Canada and that Canadian goods and Canadian workmen will be given preference throughout. The new building will be twelve storeys high and contain 250 rooms. The total expenditure involved is $1,000,000.

Several large steel bridges are now under construction in New Brunswick. The spandrel arch bridge at St. John, which bridges the Reversing Falls, and which will be utilized for street-car and general traffic, is well advanced. The east and west spans have been united in the centre, and the remainder of the work will be completed in time for use next spring. The new steel bridge, which the provincial government is constructing at Grand Falls, is almost completed, and in a few days the finishing touches will have been made to the new bridge which crosses the Miramichi River at Newcastle. In addition to these structures two large steel bridges for the use of the Valley Railway are in contemplation. The C. P. R. also has under consideration the building of a new cantilever bridge, of a somewhat different type from that now used by the railway at the Falls, St. John.

WESTERN CANADA

At Victoria, B.C., extensions to the post office are being carried out at a cost of $150,000. The general contractors are the McAlpine, Robertson Construction Company, Vancouver.

The Winnipeg City Council has succeeded in obtaining a loan of $2,000,000 for continuing the Shoal Lake water scheme. It is said that the work will now proceed without cessation for at least another year.

The Dominion Government is constructing a reinforced concrete grain elevator at Vancouver, B.C. Bids for the contract will be received by the Department of Trade and Commerce, Ottawa, up to November 13.

The new $50,000 addition to the Dominion Government building at New Westminster, B.C., is practically completed. It is anticipated that the various office staffs will be in occupation of the new building in the immediate future.

Work on the Government Immigration building at Vancouver, B.C., is now under weigh. The structure is to be five-storey, 220 x 64, brick and steel, and is estimated to cost $350,000. Messrs. Geo. Snider & Brethour are the general contractors.

In the October 14 issue of the Contract Record it was erroneously reported, on page 1282, that the fire losses at Saskatoon during the month of August last amounted to rather more than three million dollars. The actual figures were $3,037.50.

The contract has been let to Mr. J. W. Pike, of Vancouver, for the construction of an 8-ft. dyke and 20-ft. ditch at Richmond, B.C. The work will involve an expenditure of about $26,000. The object is to prevent periodical floodings of this district.

The exterior work on the new armoury which is being erected at Winnipeg for the Dominion Government, at a cost of more than half a million dollars, is nearing completion. The general contractors are Messrs. Carter-Halls-Aldinger Company, Winnipeg.

At Vancouver, B.C., the Union Steamship Company has made an offer to the civic bridges and railways committee to construct a bridge over the C. P. R. tracks at the foot of Carrall street, on plans approved by the committee, and the company has been requested to furnish plans for approval.

The new marine railway dry dock constructed by the Dominion Government at Selkirk, Man., has been formally opened. The new dock will be capable of accommodating boats up to 1,500 tons capacity. The Crandall Engineering Company were the contractors and Mr. Sweeney, District Engineer.

Members of the Regina Engineering Society visited Moose Jaw recently on the invitation of the City Commissioners. The company, which included Mr. R. O. Wynne-Roberts, Consulting Engineer, Regina, made an inspection of the principal civic works, and were also entertained at luncheon in the Royal George Hotel.

The Calgary Branch of the Canadian Society of Civil Engineers entertained the engineers in attendance at the recent International Irrigation Congress. Mr. H. B. Muckleston, Assistant Engineer, Department of Natural Resources, C. P. R., and chairman of the branch, presided, and several interesting addresses were delivered during the evening.

The Dominion Construction Company, Vancouver, have been awarded the contract for the erection of an addition to the provincial court house building, the contract price being $56,000. The plans call for a three-storey structure to face on Clarkson Street and connect with the present building. Actual construction work will begin without delay. Messrs. Gardiner & Mercer are the architects.

At New Westminster, B.C., pile driving has been started at the waterfront in connection with a new building to be erected for Mr. Jos. Meyers. The structure will comprise coal bunkers, storage sheds and office, 132 x 115 feet. The total cost will be about $8,000. Plans for the superstructure are being prepared by Messrs. Gardner & Mercer, architects. The Fraser River Pile Driving Company have the contract for the pile driving.

It is announced that practically half the main line of the Canadian Pacific Railway between Fort William and Vancouver is now double-tracked. Mr. J. G. Sullivan, Chief Engineer of the company, has stated that 350 miles of double tracking has been completed [illegible] between Brandon and the Pacific Coast. Prior to this year the road had been double tracked between Fort William and Brandon, a distance of 559 miles, making a total of 909 miles completed to date.

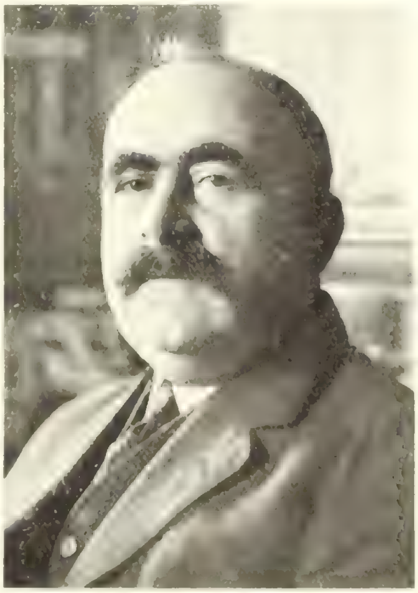
Personal Mention

Hon. Colin H. Campbell, former Attorney-General and later Minister of Public Works in the Manitoba Cabinet, died a few days ago at his home in Winnipeg.

Mr. F. W. Thorold, Toronto, has been appointed Consulting Engineer to the Board of Water Commissioners, Port Hope, in connection with the installation of a complete system of water filtration. Tenders are now being called for the intake.

Mr. R. C. Mission, sales manager, eastern division of the Sherwin-Williams Company of Canada, Limited, has been appointed manager of the eastern division with headquarters at Montreal. Mr. Mission has been connected with the Sherwin-Williams company since its inception in 1895, his first position being that of travelling representative in Eastern Canada.

John F. Connolly, Contractor



Mr. John F. Connolly.

Mr. John F. Connolly, President of the Connolly-Agnew Construction Company, general contractors, Toronto, was born in 1864. Educated at the Jacques Cartier Model School, Catholic High School and Victoria College, he became an accountant with Messrs. J. D. Adams & Company, Montreal, in 1892. Five years later he was agent at Montreal for the Allan Steamship Line. He became identified with contracting work in 1889, being partner in the firm of Clarke & Connolly. In 1899 Mr.Connolly entered the contracting business on his own account, and founded the present company on January 1, 1914. During his career he has carried out many important constructional undertakings, of which a few are sewerage systems at Prescott, Cornwall, Smiths Falls, Gananoque, St. Thomas, Ont., and Newcastle, N.B. He also built some sections of trunk sewers at Toronto, Sault Ste. Marie, Ont., and Winnipeg, and constructed waterworks systems at Steelton, Midland, Arnprior, Port Elgin, Mt. Forest, St. Marys, Owen Sound, Amherst, N.S., and Richelieu, Que. Other works carried out by Mr. Connolly include the construction of 36 x 42-inch mains at Toronto, sewage disposal works, sewerage and water systems at Bowmanville, Weston, Ont., and other centres. His [illegible] recreations are [illegible] angling and bridge.

Mr. O. W. Smith, A. M., Can. Soc. C. E., who is the contributor of an article in this issue of the Contract Record, is a native of Nova Scotia, having been born at Port Wil-

[illegible] King's County in 1870. He was educated at the Windsor Collegiate School, matriculating into King's College, Windsor, in 1893. He entered the Civil Engineering Course and four years later obtained the degree of Bachelor of Engineering. During the next two years he was engaged as instrument man on the location of the Crow's Nest Pass Railway. From 1899 to 1902 he was construction engineer of the Inverness and Richmond railway and the Cape Breton railway. From 1902 to 1904 he filled the position of engineer in charge of sewage works at Wolfville and Amherst, N. S. From 1904 to 1906 he was in charge of the Regina water and sewage works and the year following saw him in charge of design and construction of electric lighting, sewage and waterworks at Indian Head. During the years of 1907-1910 he was a member of the firm of Galt & Smith, civil and sanitary engineers, Toronto. Since 1910 Mr. Smith has been a consulting and contracting engineer at Regina, Sask.

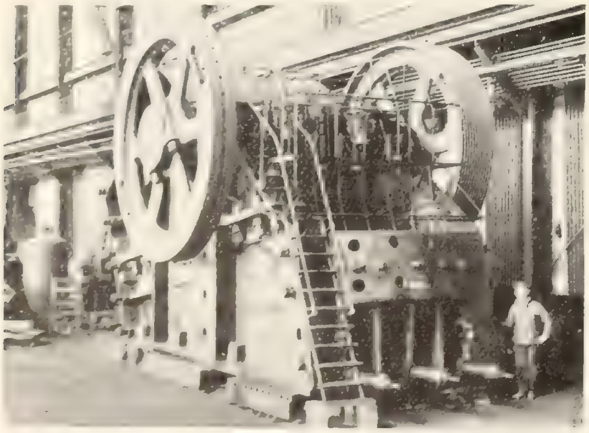
Mr. W. N. Ashplant, City Engineer, London, Ont., has offered his services with the second army contingent. Mr. 7th Fusiliers of London, Ont.

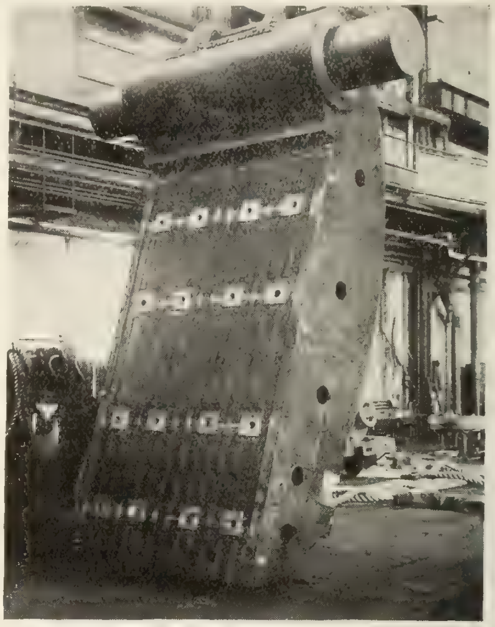
Mr. R. A. Campbell has resigned his position as superintendent of the Tagona Water & Lake Company, Sault Ste. Marie. His successor is Mr. R. D. S. Buckstedt.

Professor E. Brydone-Jack presided over the inaugural meeting of the Manitoba Branch of the Canadian Society of Civil Engineers, which was held, October 8, at Winnipeg. Mr. W. G. Chace, Chief Engineer of the Greater Winnipeg Water District, addressed the meeting on some important features of the Shoal Lake water project.

A Large Rock Crusher

A rock crusher, of the jaw type, recently built by Allis-Chalmers Manufacturing Company, is of an unusual size and capacity. The overall dimensions are, length 29 ft. 9¾ in., breadth, 16 ft. 5 13-16 in., and height 17 ft. 3 in., and the approximate weight is 510,000 lbs. The frame is made of cast steel, the ends being of the hollow box section type with internal ribs, and the sides of ribbed section. Liberal dimensions were used throughout. The pitman is made of cast steel of extra strong box section and is fitted with a removable cap which facilitates handling and makes it unnecessary to take out the entire pitman to re-babbitt the eccentric bearing in the cap. The pitman is provided with large grease cups for lubrication, and arrangements are also made for oil lubrication by means of a continuous pressure system. The eccentric or pitman shaft is made of the best quality forged steel, heat treated, 20 in. x 24 in., finished diameter, with the eccentric key forged on. The swing jaw shaft is also made of the best quality forged steel 21 in. diameter. The swing jaw weighs 70,000 lbs. without the jaw plates. It is made of cast steel, bored for the swinging shaft, and machined on the face for the receiving jaw plates and on the back for toggle seats. The cast iron flywheels are each 12 ft. in diameter. The crusher has a receiving opening 66 in. x 84 in. In operation the machine produces about 300 tons an hour with a maximum opening of 4⅞ in. between the jaws, but if the machine were opened up to 6-in. the capacity would be increased about 20 per cent. From 200 h.p. to 250 h.p. is required to operate it, depending on the character of the stone.


66 in. x 84 in. Allis-Chalmers Jaw Crusher.


Swing jaw, with jaw plates removed, of Allis-Chalmers crusher.

Book Reviews

Cast Iron and Steel Pipes. By John Sharp (New York; Messrs. Longmans, Green & Company). The author of this book, which cannot fail to be received with much interest by engineers and contractors, has had extended experience in this field and shows an expert knowledge of the subject in the observations and formulae which he adduces. The book covers all the important phases, special attention being devoted to tests and to corrosion. The author enters into an examination of "some of the more outstanding chemical and physical conditions which contribute to the comparative success or failure of either quality of pipe and which it is the desire of all engineers and other authorities to anticipate in the interest of the communities by whom they are appointed." The value of the work is enhanced by tables and diagrams.

The Link-Belt Company, Chicago, Ill., have just issued their new locomotive book, No. 158, which shows the possibilities of this equipment in regard to the efficient and expeditious handling of material. In the one machine there is combined a portable hoisting engine, swinging derrick, grab bucket unloader and switch engine. The cranes are adapted to a wide range of service and conditions. Their applications are well illustrated in the booklet.

The substructure of a bridge for the Intercolonial Railway over the Nashwaak River, N.B., consisting of two abutments and four piers, has been completed by Messrs. Baird & Howie, contractors, Fredericton, N.B. Foundation work involving some difficulty was encountered, one of the piers reaching 30 ft. below water level, while below this again excavation to bedrock was necessary. The greater proportion of the concrete work on the piers and abutments was run last winter under severe weather conditions, with no detrimental effect. The substructure will cost about $45,000.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aldborough Township, Ont.
The Township Council is contemplating carrying out extensive repairs to the Oxford & Leibner drains. Mr. G. A. McCubbin, Chatham, is the engineer, and Mr. E. A. Hughill, Rodney, is the clerk.

Amherstburg, Ont.
Bids were received from the following for cement pavement work on Richmond Street, at an estimated cost of $8,667.60:—W. C. McGee, and W. G. H. Pettypiece, Amherstburg; the Cadwell Sand & Gravel Company, Windsor. It is not likely that the contract will be let before spring. Mr. Gordon E. Pulford is the clerk.

Brooke Township, Ont.
Tenders will be received until November 21 by Commissioner W. J. Bourne, Alvinston P. O., for construction of Smith-Patterson drain extending from Station O to Station 241, a distance of 964 rods, and improvements to 9-10 sideroad drain, from Station 241 to Station 324, a distance of 332 rods. Plans and specification are at residence of Commissioner. Specification also at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Embro Township, Ont.
Tenders will be received by Mr. Allan Murray, Embro P. O., Clerk, Township Council, until November 10, for trenching, laying, covering and delivering 6,800 ft. of tile; building 3 catch basins, 2 water troughs, and concrete culvert, in connection with the Youngsville drain. Plans and specifications are with Mr. Fred Hummason, E ½, lot 19, Con. 4, and with the clerk.

Galt, Ont.
A by-law has been carried to raise $55,000 for additions and improvements to the waterworks [illegible] McCartney is the town clerk.

Hamilton, Ont.
By-law to raise $650,000 for construction of storm overflow sewers in the city will probably be voted on by the ratepayers on January 1.

The City Council has passed a by-law to raise $130,000 for construction of sewers in east end of city during the winter. Mr. A. F. Macallum is the engineer and Mr. S. H. Kent the clerk.

Montmarte, Sask.
The Town Council has been empowered by the Local Government Board of Saskatchewan to raise $3,000 to provide a water supply, skating and curling rink. Mr. A. J. Boyer is sec.-trea

Niagara Falls, Ont.
The City Council is making application to the Provincial Government of Ontario for permission to raise funds to carry out paving works this year. Mr. J. Seymour is the clerk.

Ojibway, Ont.
Tenders for approximately 3¼ miles of road grading, near Windsor, will be called shortly. Tenders for paving may be invited later. United States Steel Corporation, New York City, are the owneds. Local representative, Mr. E. Fleming, Windsor.

Ottawa, Ont.
The City Council is contemplating the construction of conduits on Bank Street at an estimated cost of $12,000. Mr. F. C. Askwith is the engineer.

The City Council is contemplating the construction of pavement on Centre St., between Adelaide and O'Connor. A decision has not yet been arrived at with regard to material to be used.

Port Rouge, Ont.
Plans and specification for extension to waterworks are at office of Mr. Edward Hamel, secretary-treasurer of Municipality of St. Jeanne de Neuville, who will receive bulk or separate tenders until November 16. Mr. E. H. Germain, Deschambault, is the engineer.

Regina, Sask.
Tenders will be received until November 16 by Mr. J. H. Turnbull, city purchasing agent, for the supply of one steel roof for rectangular filter beds being constructed at sewage disposal works. (44 trusses together with steel columns, bracing, bolts and rivets). Plans and specification are at office of purchasing agent.

The Works Department of the City Council will require to purchase the following material for construction of additional filters at sewage disposal works: 22 12-ft. lengths 18-in. cast iron water pipe of hub and spigot pattern; 2 18-in. ¼ bends, 2 12-in. ¼ bends, 2 12-in. off 18-in. tees, 1 18-in. gate valve or penstock with 7-ft. key; 2 12-in. gate valves with 7-ft. key and valve box, 1,750 lbs. lead; [illegible] lengths 12-in. cast iron water pipe. Mr. J. H. Turnbull is the City Purchasing Agent.

St. Catharines, Ont.
The City Council has notified the [illegible] on the following streets: [illegible] Francis, Merritton, and Page. The total expenditure is $2,410. Mr. W. P. Near is the city clerk.

Toronto, Ont.
Tenders close November [illegible] for the building of foundations in engine and boiler room at High Level Station for Board of Control. Plans are at Room 12, City Hall.

The Board of Control will receive tenders until November 10 for sewer construction on a number of streets. Plans, etc., are at Works Department (Sewer Section), City Hall.

CONTRACTS AWARDED

Bridgeburg, Ont.
The general contract for the construction of 1 2-3 miles of concrete boulevard through Bridgeburg and Fort Erie, has been awarded by Queen Victoria Park Commissioners, to McNamara & Nicholson, St. Catharines, Ont. Estimated cost of roadway $35,000. Mr. John H. Jackson, Niagara Falls, Ont., is the superintendent.

Canora, Sask.
The Town Council has awarded a contract to Wm. Newman & Company Winnipeg, for the supply and installation of machinery at a cost of $54,000, in connection with the municipal water system. Messrs. Chipman & Power, Mail Building, Toronto, are investigating prices on pump machinery, which latter is not included in above contract.

Orillia, Ont.
The Town Council and Water, Power & Light Commission, have awarded the following contracts in connection with $85,000 Waterworks Scheme for the municipality: Laying pipe, Mr. Herbert Caswell, Orillia, $6,000; pipe specials, National Iron Works, Toronto, $12,000; valves, Kerr Engine Works, Walkerville, $2,000; construction of pumping station and intake pipe, Norman M. McLeod & Company, Toronto. The contract for machinery will be let in the near future. Mr. W. K. Greenwood, West Street, is the engineer.

St. John, N.B.
The City Council has awarded the general contract for galvanized iron pipes to John Birch & Son, England (Agents, W. T. Thorne & Company, Market Sq., St. John).

Toronto, Ont.
The following contracts have been awarded by the Board of Control for construction of sewers in the city: R. J. Myers & Company, [illegible] Cedarvale $711; Grant Contracting Company, Evelyn $1,200, St. Clair $3,200; McKnight Construction Company, Doel $1,055 Darrell $634, Williamson $482; M. H Murphy, Costain $411; J. McGuire, [illegible] $1,750

Railroads, Bridges and Wharves

Mimico, Ont.
Negotiations are in progress for the construction of a new station on the west side of Church Street, for the Grand Trunk Railway. Mr. W. H. [illegible]row, Toronto, is superintendent.

North Cayuga Township, Ont.
Work is commenced on construction of concrete bridge over Teasdale Creek,

30 ft. span, 16 ft. wide, for township council. Mr. Geo. Ross, 80 McCaw Block, Welland, is the engineer. Mr. Wm. Lishman, Cayuga, is general contractor.

Owen Sound, Ont.
The Grand Trunk Railway is contemplating the construction here of a [illegible] next spring. The plans provide for a brick two-storey building.

St. Hilare, Que.
Tenders will be received until December 7, by Mr. J. E. N. Desrochers, for the construction of three bridges, reinforced concrete abutments, iron and steel superstructure, for the Municipal Council. The work is to be completed by September 1, 1915.

St. John, N.B.
John S. Metcalfe Company, Limited, 54 St. Francois Xavier Street, Montreal, general contractors for construction of well and pump for C. P. R. elevator, will also supply fireproof doors for elevator. Mr. H. C. Grout, King Street, is superintendent.

St. Louis de Lolbiniere, Que.
The municipal council is building a steel and concrete bridge over Domaine Creek, one span, 17 ft. wide, 80 ft. long. Construction has not yet been commenced. Mr. E. H. Germain, Deschambault, is the engineer.

Winnipeg, Man.
The Board of Control has requested Bridge Engineer Schioler to prepare plans and specifications for the construction of bridge spanning the Assiniboine River at Main Street, Maryland Street and Arlington Street. It is not probable that the bridges will be erected in the near future.

CONTRACTS AWARDED

Victoria, B.C.
The general contract for repairing Point Ellice bridge at a cost of $4,000, has been awarded by the city council to Strachan & McCaskill.

Public Buildings, Churches and Schools

Birch Cliff, Ont. (Toronto)
School Section No. 10, Scarboro Township, has in contemplation an addition to Danforth School, or as an alternative the construction of a new building near Birch Cliff. Mr. Peter Heron, Scarboro Junction, is the secretary.

Bredenbury, Sask.
The Saskatchewan Local Government Board has authorized the raising of $2,800 for the completion of Bredenbury town school and the installation of steam plant. Mr. A. Rodgers, Bredenbury, is secretary-treasurer.

Charlottetown, P.E.I.
The telegraph office, corner of Water and Queen streets, is being remodelled at an estimated cost of $2,000, 2-storey 46 x 36, brick construction. H. & S. Lowe are the architects and general contractors. Mr. W. E. Owen is the owner.

Digby, N.S.
Bank building, etc., occupied by Royal Bank of Canada, and Gilbert Warner, grocery store, has been destroyed by fire. The loss, estimated at $5,000, is covered by insurance.

Deep Brook, N. S.
Colonial Arms Hotel, (Mr. John D. Spurr, Prop.) contemplates building smaller hotel to replace one recently destroyed by fire. A number of cottages will also be built. Work will start next year.

East Garafraxa Township, Ont.
School trustees, Section No. 16, will supervise the purchase of school furniture for school building. The trustees are: Messrs. Geo. Lights and Jos. Carey, Jr., Amaranth.

Hamilton, Ont.
The contract will be awarded shortly for construction of hospital kitchen to cost about $35,000, for Hospital Board. This is part of scheme for alterations and addition to hospital at an estimated cost of $100,000. Building will be hollow tile, reinforced concrete and brick construction.

Lucan, Ont.
Plans are completed, but tenders have not yet been called for construction of $2,500 church, white brick construction, for Lucan Methodist body. Mr. J. V. Munro, Bank of Toronto Chambers, is the architect.

London, Ont.
Chairs and stoves are to be purchased for new Sunday School on Wharncliffe Road, for St. Paul's Presbyterian Church. Mr. C. W. Alford, 101 Wharncliffe Rd., is secretary of Building Committee. Evans Bros., 905 Queen's Avenue, are the general contractors.

Montreal, Que.
Alterations to church on McGill College Avenue, estimated to cost $2,000, are to be carried out by Mr. L. Cohen, 36 Prince Street. Plans are drawn by Mr. C. Dufort, 198 St. Catherine St. W. Guertin & Bonchard, Ontario and Parthenais Streets, are the general contractors.

Mr. A. J. H. St. Denis (Hotel Reindreau), 20 St. James Street, is having additions and alterations, estimated to cost $15,000, made to hotel. Mr. Roi, care owner, is the general contractor.

Ottawa, Ont.
Certain sub-tenders are to be awarded shortly in connection with the $156,000 church on Fairmont and Wellington Streets for the Capuchin Fathers. Mr. Chas. Bordeur, Quebec, is the architect.

Prince Rupert, B.C.
The contract for erecting a detention building for Dominion Government Department Public Works, at an estimated cost of $6,000, has been awarded to Mr. Geo. Munro. Building will be steel and reinforced concrete construction.

Souris, Man.
By-law to authorize construction of school at an estimated cost of $8,000, for Consolidated School District of Carroll, No. 868, has been passed. Building will not be started until next spring. Mr. J. W. Brakey, Souris, is secretary-treasurer.

Sudbury, Ont.
A telephone system will not be installed in connection with alterations to school for Separate School Board. Mr. S. Fournier is secretary of the Board.

Toronto, Ont.
Plans have been prepared for Manual Training and Domestic Science school building at rear of King Edward school, Bathurst Street. Mr. W. C. Wilkinson is secretary, Board of Education.

The Advisory Industrial Committee, Board of Education, have passed appropriations for $45,000, for the purchase of engines, generators and other machinery for the new technical high school building. Mr. W. C. Wilkinson is secretary-treasurer, Board of Education.

Plans are being prepared for an addition of six rooms and an assembly hall to the Broadway Avenue High School, North Toronto, for the Board of Education.

Plans are ready and tenders will be called shortly for new school building to be erected on Colbeck and Runnymede Streets for Board of Education.

Time for receipt of tenders has been extended and bids close November 10 with S. B. Coon & Son, Ryrie Building, architects, for 10-room school, two storeys and basement, 130 x 80, in East Toronto, for School Section No. 15, York Township. Mr. W. H. Bessey, 26 Enderby Road, is the clerk.

The Toronto Bowling Club (Manager, T. F. Ryan, 36 Church Street), are moving into the new Bond Building shortly. Additional equipment, including 10 bowling alleys, 6 billiard tables and grill room will be required.

Tenders will be invited shortly by the Board of Education for wall tile work in engine room, approximate cost $2,000, in connection with new Technical High School. Mr. W. C. Wilkinson, is the sec.-treas., Board of Education.

Weston, Ont. (Toronto)
A golf club, in which Mr. T. W. Rogers and Mr. H. J. Church are interested, is in course of formation. A club house will probably be erected next spring. Course will be laid out on the Wodsworth estate.

Wetaskiwin, Alta.
The Wang School District, No. 550, contemplates the erection of a school building. The board has been empowered to raise $1,200 for this purpose. Mr. P. W. Strand is the secretary-treasurer.

Winnipeg, Man.
Plans are drawn for Children's Home to be erected on Tuxedo Park. Contract has not yet been awarded. Mr. J. H. G. Russell, McArthur Building, is the architect.

CONTRACTS AWARDED

Glace Bay, N.S.
The general contract for construction of wooden building with bunks, dining room and kitchen at military buildings, have been awarded by the Dominion Government, Department Militia & Defence, to Mr. H. Cameron, Glace Bay.

McBride, B.C.
The contract for the construction of $9,000 Courthouse has been awarded by the Provincial Government Department of Public Works, to Mr. Geo. McWilliams, P. O. Box 829, Victoria. Hon. Thos. Taylor, Victoria, is Minister of Public Works.

Perth, N.B.
Work will start next spring on construction of school for School District

No. 14, the general contract for which has been awarded to Baird & Howie, Fredericton. The building is estimated to cost $6,400. Mr. R. B. Richie is the secretary.

Quebec, Que.
The Dominion Government, Department Militia and Defence, is constructing a $5,000 inspection building on the Ross Rifle property, two-storeys, brick construction. The general contract has been awarded to Mr. W. Sharpe, Quebec; roofing, heating, plumbing and electric work, Mr. F. Gingras, Quebec.

Regina, Sask.
The general contract for erection of $6,000 Lodge Hall for Oddfellow's Lodge of Regina, has been awarded to Messrs. Murphy & Martin, Regina. The building will be 48 x 60, frame and brick construction. Mr. W. A. Hamilton, 2259 Lorne Street, is the architect.

Toronto, Ont.
The Board of Education has awarded the following contracts in connection with the construction of Ryerson School annex:—Masonry, Witchall & Son, $28,200; concrete floors, Ramsay Contracting Company, $1,092; carpentry, Hutchinson Woodworker & Contracting Company, $10,495; plastering, Beaver & Company, $3,798; painting, J. Cosey, $1,380; heating and ventilating, W. J. McGuire Company, $4,700; plumbing, W. J. McGuire, $4,300; iron stairs, W. D. Beath & Son, $2,755; wiring, A. R. Rice & Company, $334; heat regulating, Canadian Powers Regulating Company, $793.

The following contracts have been awarded by the Board of Education in connection with structural addition to Roden Street School:—Masonry and reinforced concrete floors, G. T. Gayton, $12,200; carpentry, Wm. Williamson, $7,295; plastering, Geo. White, $2,600; painting, F. J. Cox, $799; wiring, A. R. Rice & Company, $182; heating and ventilating, Bennett & Wright, $777; plumbing, F. Armstrong Company, $3,388; roofing, Duthie & Son, $1,130; iron stairs, W. D. Beath & Son, $1,680; heat regulating, Johnson Temperature Regulating Company, $419.

Business Buildings and Industrial Plants

Chatham, Ont.
The Sutherland Innis Company's header mill, dry kiln and boiler house have been destroyed by fire.

Collingwood, Ont.
The erection of an [illegible] plant at a cost of $3,000 next spring, is contemplated by Mr. James Vansise.

Edmonton, Alta.
Plans are drawn and work will start at once on construction of [illegible] near St. Albert Trail for the Edmonton, Dunvegan and B. C. Railway.

Halifax, N.S.
Business block on Barrington, [illegible] and Sackville streets has been destroyed by fire. The loss, including destruction of stone front, is estimated at $125,000.

Harwich Township, Ont.
The erection of tobacco buildings at an estimated cost of [illegible] is contemplated by Mr. John A. Cameron, Blenheim P. O.

Listowel, Ont.
Perfect Knit Mill Company has selected a site for a $4,000 addition to knitting mills, 30 x 60, Monkton brick construction.

The Dominion Railway Board has ordered inter-switching facilities between G. T. R. and C. P. R. in connection with erection of $100,000 factory for Messrs. Libby, McNeil & Libby, Chicago, Ill.

London, Ont.
The factory owned by the Dominion Brass Corporation, 171 Bathurst Street, and C. N. W. Shoe Company, has been destroyed by fire. Loss, estimated at $20,000, is covered by insurance.

Maisonneuve, Que. (Montreal)
The Municipal Board is having foundations placed in connection with the construction of $150,000 bath. Work will not proceed any further this year. Mr. Marcus Dufresne, Ontario Street, is the architect.

Montreal, Que.
The interior of the Venice Cafe, 318 St. Lawrence Blvd., has been damaged by fire. Loss about $3,000.

Plans will be completed and tenders called in a few days for the general contract in connection with the construction of a theatre and apartment house estimated to cost about $300,000. The building will consist of roof garden, grill room in basement, theatre to seat 3,500, concrete foundation, reinforced concrete, terra cotta, fireproof, hollow tile and steel construction. Theatre will be built by a syndicate. The Promotion Company of Canada, Transportation Building, Montreal, are said to be interested. Mr. J. H. McDowell, Drummond Building, is the architect.

The architects, Messrs. Aquin & Brault, 908 New Birks Building, are receiving tenders on general contract, including plastering, painting and carpentry, for alterations to stores on Notre Dame West, estimated to cost $5,000. Plans provide for brick construction, electric lighting. Mr. Payne, care architect, is the owner.

Plans are drawn for alterations to restaurant and residence, 117 St. Catherine Street East, for Societe Nationale D'Immeubles, 35 St. James Street, estimated to cost $2,000.

Ottawa, Ont.
The erection of a central yard and work shop for the city has been recommended by Mr. F. C. Askwith, City Engineer.

The [illegible] is contemplating roofing Main and Dairy buildings, raising and brick veneering wooden buildings, at [illegible]. The architect has not yet been chosen. Mr. H. [illegible] is secretary.

Plans are in preparation for three-storey brick veneer stores and apartments to be erected on [illegible] Street at an estimated outlay of $12,000. Mr. C. D. Joyce, 1102 Somerset Street, is owner and architect.

Petrolia, Ont.
Plans have been drawn for [illegible] restaurant for Mr. F. Bruton, care Bruton's Cafe. Building will be reinforced concrete and white brick construction. Fixtures will also be required.

Port Elgin, Ont.
Plans are drawn for erection of a basket-making factory, [illegible] concrete block construction, for Mr. Simon Buschlen, owner and architect. Owner will purchase basket-making, wood-turning and pump-making machinery.

Regina, Sask.
A loss estimated at $6,000 has been sustained by the City Council from damage by fire to warehouse on St. John and 8th Street, of which they are the owners. The building was occupied by the Stamco Bedding Company, Limited, 1355 St. John Street, P. O. Box 28.

The Canyon City Sawmills Company, Limited, Creston, B.C., have erected temporary buildings in connection with their lumber business at Innismore. Permanent buildings will not be constructed until the spring. Mr. N. J. Eastman is business manager.

Work will start in a few months on the construction of a $10,000 warehouse, two-storey, 125 x 75, for Cushing Bros., Dewdney & McIntyre Streets.

St. Catharines, Ont.
Plans and specification are being prepared but are not yet completed for two-storey stores and offices for Mr. J. Widdicombe, 42 James Street.

St. Stephen, N.B.
Trimble Bros. & Company, St. Stephen, have lost by fire a shoe factory. Damage estimated at $35,000, insurance $24,000.

Sarnia, Ont.
Sarnia Sheet Metal Products Company, Limited, is reported to be in the market for the purchase of $40,000 worth of machinery to be utilized in the manufacture of sheet metal goods. Mr. Lloyd Lott is the manager. Specification and plans have been prepared by the architect, Mr. R. W. Soper, Front Street.

Toronto, Ont.
Humber Beach Hotel, Humber Bay (manager, Mr. Connolly), has been destroyed by fire. Loss is estimated at $60,000, insurance about $50,000.

The erection of a ten-storey fireproof hotel building on Adelaide and Bay Streets, is contemplated by Mr. J. J. McCaffrey, Bay Tree Hotel, Toronto.

Tenders will be received by Mr. C. A. Ward, 1156 Dundas Street, for addition of one floor to present warehouse building, 300 x 60 ft., reinforced concrete walls and roof. Plans are on the job.

Messrs. McLaughlin-Gourlay Company have started work on alterations to hotel owned by Hoshals Limited, 30 King Street West. Improvements, which will include new front, floors and partition, are estimated to cost $20,000.

Vancouver, B.C.
The Trades and Commerce Department, Ottawa, are open to receive tenders until November [illegible] for construction of [illegible] Grain Elevator at Burrard Inlet. Elevator is estimated to cost from [illegible] to [illegible]. Plans and specifications are at office of Chief Engineer, Board of Grain Commissioners, [illegible] Building, [illegible], and of Department, Ottawa.

Tenders will be called shortly for erecting [illegible] Immigration Building for Dominion Government Department of Public Works. Building will be five storeys, [illegible] steel and stone construction. Mr. R. C. Desrochers is Secretary, Department of Public Works.

Messrs. Geo. Snider & Brethour, Vancouver, are the general contractors.

Westmount, Que. (Montreal)
Plans are drawn for construction of $7,000 garage on Stayner Avenue for Mr A. F. Haralson, 1017 Green Avenue. Mr. Sydney Comber, 145 Green Avenue, is the architect. The general contractor is Mr. Robert Shaw, care Mr. Chas. Blakeley, Claremount Avenue.

Windsor, Ont.
Plans are in progress for addition to store on Chatham Street for Mr. Fitzbridge at an estimated cost of $4,000. The general contractors, Thompson Bros., 26 Pitt Street West, will sublet smaller trades. Tenders will not be called. Building will be one storey, 40 x 40, brick construction. Leybourne & Whitney, Sandwich Street East, are the architects.

The construction of a plant for the manufacture of structural steel, woodwork, etc., is contemplated by Messrs. Thos. J. Eansor & Company, Pitt Street East, Windsor. Building will be brick construction.

Winnipeg, Man.
The chemical warehouse on Pacific Avenue and Libey Street, owned by Mr. J. Rosenthal, 413 Stradbrook Avenue, has been destroyed by fire. The loss, stated to be $25,000, is partly covered by insurance.

Plans are drawn and work will probably be started next spring on construction of two-storey addition, steel, hollow tile and reinforced concrete garage on Broadway and Sherbrooke Streets, at an estimated cost of $60,000. The Breen Motor Company, Winnipeg, are the owners. Mr. J. Simmons, McArthur Building, is the architect.

Wolfville, N.S.
Tenders have not yet been called, but work is expected to commence this fall on construction of $8,000 skating rink for Arcadia College. Dr. Geo. B. Cutten is president.

CONTRACTS AWARDED

Bonilla Island, B.C.
The contract for construction of lighthouse, etc., for Dominion Government Department of Public Works, has been let to Messrs. Weldon & Talbot, New Westminster. A reinforced concrete tower, frame residence, oil shed and boat house are also to be built. Mr. R. C. Desrochers, Ottawa, is Secretary, Department Public Works.

New Westminster, B.C.
The contract for the erection of a hay shed in connection with the $60,000 Elevator and Warehouse for Brackman-Ker Milling Company, Front Street, has been awarded to Mr. J. Lord at $6,888.

Sherbrooke, Que.
The contract to erect two-storey garage here has been awarded by Mr. P. Desrochers, Windsor Street, to J. Simoneau, 53 Murray Street.

Toronto, Ont.
The masonry contract for four detached stores and residences on Danforth and Carlaw Avenues, to be erected for Mr. W. H. Leacock, 17 Queen Street West, at an estimated cost of $16,000, has been awarded to Rees & Hawkin, Toronto. Other contracts have not yet been awarded. Building will be three-storey, 80 x 60, brick construction. Messrs. Burke, Horwood & White, Ryrie Building, are the architects.

The Provincial Hydro-electric Commission of Ontario has awarded to Witchall & Son, 163 Havelock Street, the contract for the general construction of Office Building on University Avenue, at an estimated cost of $200,000. The building will be six storeys and basement, 88 x 66, steel, terra cotta and brick construction. The contract does not include heating, plumbing, wiring and interior decoration. The work is to be completed in eight months. Construction will begin immediately.

The contract for painting, iron work, etc., around the Union Station, Front Street West, has been awarded to J. J. O'Hearn & Son, Toronto.

Vancouver, B. C.
The genearl contract to erect $5,500 store on Pender Street for Mr. H. E. Carry, 1306 Cardero Street, has been awarded to Messrs. J. Carver & Company, Vancouver. The general contractor is asking for tenders on all trades. Store will be one-storey, brick construction.

Windsor, Ont.
The sub-contract for $5,000 garage for Mr. Fitzbridges has been awarded to Mr. Wm. Walker, 41 Jeanette Street.

Residences

Camrose, Alta.
Tenders will be received by Mr. V. Matson, owner, for construction of one pair of $3,000 residences, two-storey, 24 x 26, concrete foundation, frame construction.

Cannington, Ont.
The erection of one pair of residences next year is contemplated by Mr. W. A. Robertson.

Guelph, Ont.
Plans are drawn for a residence on Morris Street, for Mr. Chas. Crenna. Owner will do all contract work.

Plans have been drawn for two-storey addition to residence of Mr. W. F. Barber, 98 Glasgow Street, owner and architect. The contracts for roofing and plastering are to be let.

Hamilton, Ont.
The contract for trades other than masonry are to be awarded shortly in connection with construction of $4,000 residence on Mount Park Avenue for Mr. A. Waters, care architect. Mr. Fred W. Warren, Bank of Hamilton Building, is the architect. Mr. E. C. Mitchell, 90 Shannon Avenue North, has the contract for masonry work.

Kingsville, Ont.
Interior alterations and additions to residence of Mr. W. A. Hendershot, Main Street, are in contemplation.

London, Ont.
The I. O. O. F. (Chorazin Lodge 190) has in contemplation the erection of a Lodge Hall. The project will be considered at next meeting.

Montreal, Que.
Plans are drawn for alterations to two flats for Mr. O. Belanger, 680 St. Hubert Street, estimated to cost $2,500. Mr. E. LeBlanc, 2213 Waverley Street, is general contractor for the building, which will be one-storey, 14 x 12, concrete foundation.

Niagara Falls, Ont.
Plans are in progress for construction of two residences here for Mr. M. J. Bayland, care Dawson Bros., Queen St. Mr. J. U. Collins, Benson Street, is the architect.

Oakville, Ont.
The contracts have not yet been let for electric fixtures, mantels, built-in refrigerators, plastering and hardwood trim in connection with $5,000 residence on Dundas Street, two-storey, pressed brick construction, for Mr. L. C. Ashbury. Mr. C. Naylor is the general contractor.

Ottawa, Ont.
Mr. Thos. Dean, 170 Cambridge St., has in contemplation the erection of a $3,800 residence on Beverley Street, to be double brick veneer construction.

The construction of a residence on Fentiman Street at an estimated cost of $5,200, is contemplated by Mr. B. A. Grison, 100 Fentiman Avenue, owner and architect. Residence will be concrete block construction, concrete foundation, shingle roofing.

The construction of three residences on Marlboro Street, at an estimated cost of $15,000, is contemplated by Cohen Bros., Osgoode Station. The building will be 2½-storey, concrete and brick veneer construction.

Plans are practically finished for construction of residence, etc., for Mr. J. Gosman, Minto Hotel. A sewage disposal plant, water tank, etc., are required. Mr. Frank Sullivan, Castle Building, Ottawa, is the architect.

Ripley, Ont.
The construction of a $3,500 residence, brick construction, is contemplated by Mr. John Logan. An architect is to be appointed.

Seaforth, Ont.
A residence estimated to cost $3,800 is contemplated by Mrs. Thos. McQuade, Goderich Street. The building will be brick construction. An architect will be appointed.

St. Hilaire, Que. (Montreal)
The architects, Aquin & Brault, New Birks Building, Montreal, will invite tenders shortly for addition and alterations to residence of Hon. Judge Paul Martineau.

St. John, N.B.
Mr. R. H. Bruce, care Armstrong & Bruce, Prince William Street, has in contemplation the construction of fifty $1,800 residences on Fort Howe Street, Buildings are to be concrete foundation, frame construction, shingle roofing.

Toronto, Ont.
Plans are drawn for a residence on 469A Concord Avenue, for Mr. J. W. Brown, 11 Wells Hill Avenue, owner and general contractor. Residence will be two storeys, brick construction.

Tenders are wanted on lathing, plastering, wiring, painting and eave-troughing of residence for A. W. Walker & Son, 24 Kennedy Road.

Tenders are required for carpentry work on six houses on Dawes Road for

Mr. J. Stanhope, 42 Balfour Avenue, owner and general contractor.

West Lorne, Ont.
The carrying out of alterations and additions to residence is contemplated by Mr. Archibald Wiley, Graham Street.

Westmount, Que. (Montreal)
In connection with the construction of sixteen $30,000 residences on Roslyn and Grosvenor Streets, for Mr. John H. Hand, 609 Belmont Avenue, owner and general contractor, eight have been completed and of the remainder the owner is undecided whether to proceed with the construction or not. Residences are three-storey, 30 x 60, reinforced concrete construction.

CONTRACTS AWARDED

Niagara Falls, Ont.
A contract to erect residence here for Mr. Hamilton, Taylor Street, has been awarded to Mr. Noble Benson, Lundy's Lane. The general contractor will purchase material. No sub-contracts will be let.

Port Rowan, Ont.
The contract to erect a white brick residence for Mr. R. Wood, College Avenue, has been awarded to Mr. Geo. Louks, care owner.

Power Plants, Electricity and Telephones

Chatham, Ont.
The City Council has in contemplation the erection this year of a hydro sub-station. The site has not yet been secured nor plans prepared. Mr. W. G. Merritt is city clerk.

Delaware, Ont.
The Village Council is planning to instal a lighting system and equipment for distributing power to various private consumers. Mr. J. B. Rice is the secretary.

Dutton, Ont.
The Hydro-electric Commission of Ontario is contemplating the purchase of equipment in connection with the running of a line from St. Thomas to Dutton and Glencoe. Mr. J. B. Blue is clerk of Dutton.

Flesherton, Ont.
The Town Council has carried a by-law providing for extension of hydro-electric system to Flesherton, at an estimatde cost of $5,500. Mr. W. H. Thurston is the town clerk.

London, Ont.
It is the intention of the City Council to invite tenders about [illegible] for two water wheels, turbine [illegible]ous motors, etc., for Springbank pumping station. Mr. H. J. Glaubitz, City Hall, is the engineer.

In connection with the construction of an addition to Electrical Distribution Plant, 30 ft. high, by 50 x 50 ft., solid brick construction, at an estimated cost of $15,000, it is said that new machinery will not be purchased until spring. Mr. H. J. Glaubitz is the engineer.

Montreal, Que.
The City Council has approved the expendtiure of $5,500 on the construction of a pump house at Elgin basin sewers

St. Malo, Que.
Tenders close December 1 with the Commissioners of the Transcontinental Railway, Ottawa, for supplying and installing the following plant in the Leonard locomotive and car shops; boilers and stokers, feed water heater, steam engines or turbines, generators, switchboard and wiring. Plans and specification are at office of Mr. W. J. Press, mechanical engineer, Ottawa. Mr. B. E. Ryan, Ottawa, is secretary to Transcontinental Railway Commissioners.

Winnipeg, Man.
The contract to supply boiler for steam fire engine has been awarded by the Board of Control to Doty Engine Works Company, Limited, Winnipeg, at $1,015.

Miscellaneous

London, Ont.
Dominion Savings Company, Talbot and Dundas Streets, will require vault equipment as they will shortly be moving into their new building at the corner of King and Richmond Streets. Possible contractors are advised to communicate with Mr. Harvey, care the company.

The Northern Life Association Company, London Life Building, contemplates the purchase of office furniture, etc., including tables, desks, chairs and vault fittings.

Ottawa, Ont.
Mr. F. C. Sullivan, architect, Castle Building, Queen Street, has recommended that the contract for construction of lavatories on O'Connor Street, at an estimated cost of $14,000, be awarded to Murphy Bros., 493 Cooper Street. Building is to be solid brick construction.

Regina, Sask.
City purchasing agent, Mr. J. H. Turnball, will receive tenders until November 16 for supply of approximately 99,000 sq. ft. of corrugated galvanized roofing and siding, together with ridge roll, gutters, downpipes, discharge bends, nails and washers. Plans and specification are at office of purchasing agent. Mr. F. McArthur is the city engineer.

Toronto, Ont.
The Canadian Metal Company, Toronto, has received a contract from the British Government for the manufacture of moulded bullets for shrapnel shell. In connection with the order the announcement is made by a member of the company that a tower 100 ft. high will be constructed immediately for the work.

Tenders for travelling crane have been opened by the Board of Control and referred to Mr. R. C. Harris, Commissioner of Works for report. The lowest bid received was $1,850.

New Companies

The [illegible] Company, Limited, [illegible], has been incorporated as a joint-stock company.

The Essex Motor Cycle & Machine Company, Limited, has been incorporated with head office at Essex, Ont. The company's operations will be mainly manufacturing of motors and motor cycles. The company has a capital of [illegible].

The Saskatchewan Concrete Post Company, Limited, is a newly incorporated company at Regina, Sask., with a capital of $25,000. The company will manufacture concrete posts. Mr. F. H. Reed, 2347 McIntyre Street, is president. Mr. R. E. Brown, S. Railway and Albert Street, is managing-director.

The Marine Welding Company has been licensed in the Province of Ontario to engage in the general business of welding steel, iron and other metals and to manufacture and deal in all kinds of machinery and appliances used in the welding process. The capital of the Ontario Corporation is $40,000. Mr. Wm. Batten McPherson, Toronto, is the company's attorney.

The Sharpe Construction Company, Limited, is a new incorporation with head office at Quebec, Que. The company, which has a capital stock of $200,000, will carry on the business of general contractors.

Lamarre & Compagnie, Limitee, have been incorporated as a construction and manufacturing company to carry on business as builders and manufacturers of machinery. The company has a capital stock of $195,000 and the head office will be at St. Remi, Que.

The Blashill Wire Machinery Company, Limited, has been incorporated with head office at Montreal, to carry on the business of steel makers, colliery proprietors, miners, engineers and iron founders. The company has a capital stock of $48,000. The provisional directors include Judson Albert DeCew, chemical engineer, and Louis L. Cohen, merchant, of Montreal.

Explosives produced in the United States during 1913, according to statistics issued by the U. S. Bureau of Mines, amounted to 463,514,881 lb., as compared with 489,393,131 lb. for 1912. This production is segregated as follows: Black powder, 194,146,747 lb.; "high" explosives, 241,682,364 lb.; and permissible explosives, 27,685,770 lb.

All the structures at the repair-shop plant of the Canadian Northern Railway, at Port Mann, about 16 miles from Vancouver, B.C., were completed September 1, and are now ready for the installation of equipment. The main buildings are constructed of reinforced concrete with wood and steel roof trusses. The largest structure is 276 x 143 ft. in plan, and is laid out in two main bays, one for erecting and the other for repair purposes. Other structures are a 15-stall round house, an 80-ft. turntable, a store house, boarding house to accommodate [illegible] men, and an 80,000 gal. steel water tank on a steel tower. The main repair shop has a 30-ft. gallery or elevated platform running the full length of the building and intended for light repair work. The two main bays of this structure are to be served by 10-ton travelling cranes, and modern drill, press and lathe equipment is to be installed. For lifting locomotives there is planned an electrically operated pair of jacks which can be spaced as desired between the limits of 25 and 45 ft. The new shops are about [illegible] miles from [illegible] the Fraser River [illegible] the construction [illegible] now in progress in the interior of British Columbia.

Tenders and For Sale Department

CAPITAL [illegible] for sound enterprises of all kinds. [illegible] commission. Bond and stock [illegible]. [illegible] procured. Refer [illegible] exchanged. Address Cooke & Byrne, Har[illegible] Street, Dublin, Ireland. 40-45

Mechanical Superintendent

[illegible] this position in connection with operations in England, Canada, [illegible]. Capable of taking absolute control of mechanical end of any project. [illegible] Box 87, Contract Record, Toronto. 42-44

Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory you can cover. Box 96, Contract Record & Engineering Review, Toronto. 44-47

Agents Wanted

Canadian firms having good municipal connections can make money selling a new improved sewer cleaning machine which already has a big sale in the U. S. A. Write stating the territory you can cover. Box 97, Contract Record & Engineering Review, Toronto. 44-46

Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales agents for Canada. These transformers are for sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammeters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle. Box 93, Contract Record, Toronto. 43-44-45

Late News Items

Brantford, Ont.

The Park Drive road scheme may be temporarily abandoned owing to the cost which is now estimated at $60,000. A meeting to consider the scheme will be held by the City Council immediately.

Cranbrook, B.C.

The City Council has disposed of $35,000 worth of waterworks debentures at 88, for the purpose of enabling the city to complete the distributory system this fall.

Fort George, B.C.

A deputation from this municipality interviewed the Provincial Government recently in connection with the proposed installation of a waterworks system for Fort George. The estimated cost of the system is about $52,000.

Hull, Que.

The Fire Department of the City Council has decided to purchase one horse-drawn fire engine. Mr. Tessier, City Hall, is Chief of Department.

Hamilton, Ont.

The sub-contract for masonry and brick work on residence for Messrs. Sparks & McKay, Fairholt Road, has been awarde dto Mr. Jas. Poustie, Whitfield Avenue. The building will be two-storey, brick construction.

Kingsville, Ont.

The construction of a frame and white brick residence at a cost of $3,000 is contemplated by Mr. A. Wigle, Division Street.

Kamloops, B.C.

Money bylaws totalling $50,500 will be placed before the ratepayers shortly for the development of the electric light service in the city, extension of water service, and park improvements.

London, Ont.

Plans are drawn by Mr. A. E. Nutter, Dominion Bank Chambers, for erection of church on Maitland Street, for Latter Day Saints. Construction work will not start until next spring.

Niagara Falls, Ont.

The rebuilding of a barn, destroyed by fire recently, is contemplated by the owner, Dr. Watson. Estimated cost $4,000.

Ottawa, Ont.

The City Council has in contemplation the construction of a tile pipe sewer on Nicholas Street between Somerset and Mann Avenue. Mr. R. L. Haycock is Sewerage Engineer.

Work is to start immediately on construction of sewerage works comprising tile, concrete and brick sewers and installation of septic tanks. The City Council is undecide dwhether to let contract or carry out the work by day labor. The scheme is estimated to cost $60,000.

Punnichy, Sask.

The Council of the Rural Municipality of Emerald, No. 277, has been authorized to raise $6,000 to construct main roads. Mr. S. T. Thorne, Punnichy, is Secretary-Treasurer.

Regina, Sask.

The Board of Highway Commissioners intends to drain land in townships 31 and 32 at an estimated cost of $23,384. Mr. F. J. Robinson is Chairman.

St. John, N.B.

A Syndicate promoted by Mr. Arthur Likely, City Road, has in contemplation the construction of 100 frame residences in the eastern section, at an estimated cost of $1,600 each.

Summerland, B.C.

The Municipal Council has passed a new bylaw authorizing the raising of $10,000 to finance the extension and improvements being made to the irrigation distribution system within the municipality.

Toronto, Ont.

The City Council has passed a bylaw authorizing the issue of bonds to raise $250,000 for the purchase of parks and playgrounds.

The recommendation of the Board of Control that Commissioner Harris be authorized to construct a civic car line from Dundas Street to Quebec Avenue and Bloor Street has been adopted by the City Council. The laying of the track will cost approximately $125,000.

The Toronto-Hamilton Highway Commission has appointed Mr. H. S. Van Scoyoc, of Montreal, Chief Engineer on the new permanent highway to be constructed between Toronto and Hamilton. Construction work will begin immediately.

Mr. C. E. Deakin, Montreal, general contractor for the new power plant and boiler house of the Canadian Kodak Company at Mount Dennis, Toronto, has awarded a sub-contract for the concrete piles for the foundation of the building to the MacArthur Concrete Pile & Foundation Company, 11 Pine Street, New York, N.Y.

Winnipeg, Man.

The Grand Trunk Pacific Railway has let a contract to Carter-Halls-Aldinger Company for the construction of terminals at four divisional points in British Columbia — Prince George, Endako, Smithers and Pacific. The amount of the contract is approximately $300,000. Work has already commenced.

To prevent concrete from sticking to wood molds use a thin mixture of lard and lard oil, or liquid waterproofing, or dampproofing; when this coat is thoroughly hard, give rub with cloth slightly moistened with mixture of lard and lard oil, before each cast is made. This same mixture can be applied to iron molds, but mixtures can be thinned with kerosene. Prepare plaster mold with a mixture of linseed oil and yellow beeswax; let this soak well into the mold; after two days wash with kerosene; before each casting brush mold with mixture of stearic acid dissolved in kerosene. This should be very thin.

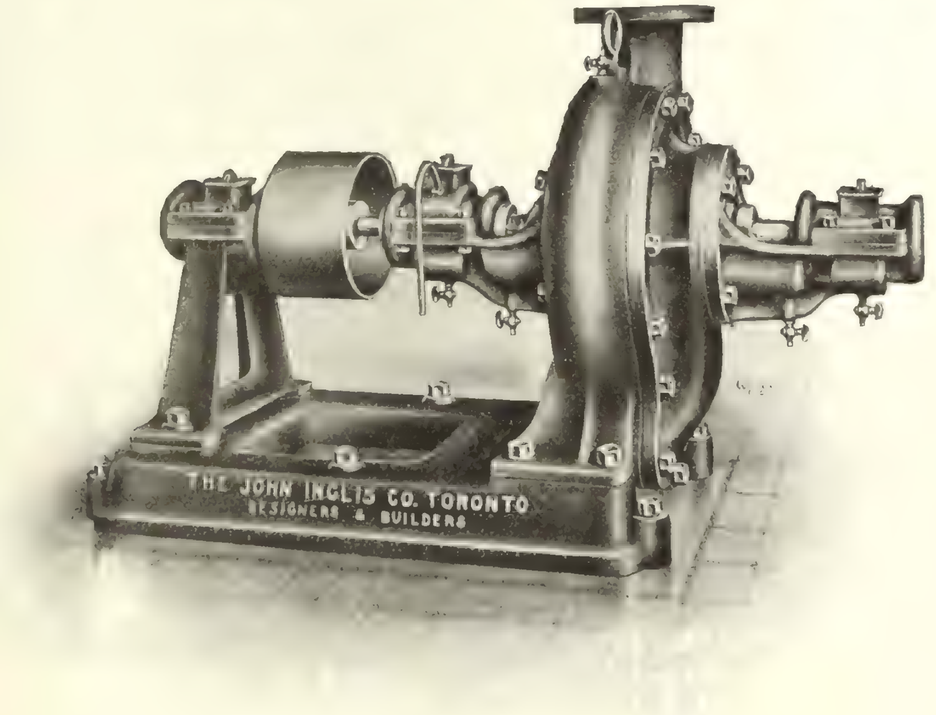
For glue or gelatine molds when glue is well hardened, prepare a coating of three parts alum and one part formaldehyde. This hardens the surface of the glue and protects t against the action of cement, so that several casts can be made. Before each cast brush freely wth mixture of stearic acid and kerosene.

Care must be taken to screen glue after remelting, to eliminate the hard, thin coating which has become insoluble under the action of the formaldehyde.

Highway crossing accidents were discussed by Mr. M. A. Dow, general safety agent of the New York Central Lines, at the third annual Safety Congress held in Chicago recently. Mr. Dow found that of 7779 persons who traversed the New York Central tracks at three distinct locations in Syracuse, Detroit and Indianapolis, between 7 a.m. and 5 p.m. one day last December, only 359 looked both ways before crossing.

A $3,000,000 loan for sewerage purposes will be voted on by the citizens of Balitmore, Md., at an election this month. The funds will be used to complete the east and west low level interceptors, the Jones Falls interceptor, the high level interceptor and to extend the sanitary lateral sewers and storm-water drains in the northeastern, southeastern, southwestern and northwestern sections of the city and the suburbs of Arlington, Woodberry and Govanston, thereby completing the sewering of the entire built-up portion of the city with sanitary sewers and storm-water drainage.

PUMPS



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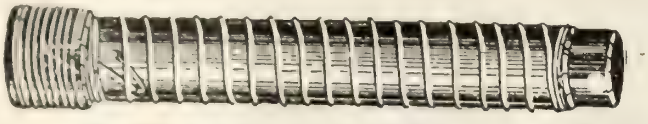

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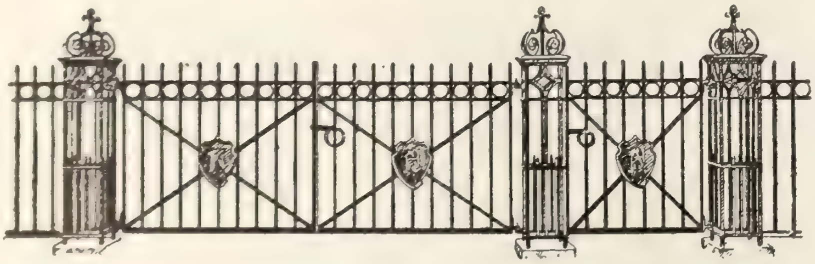

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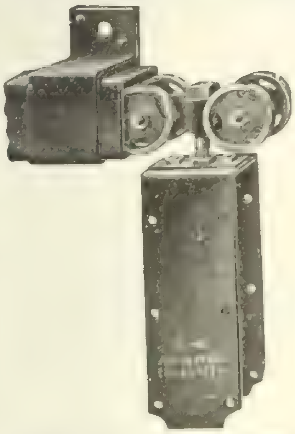

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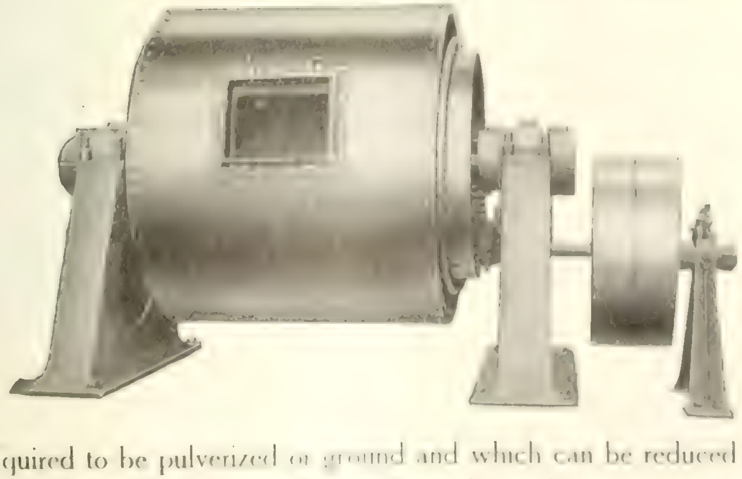

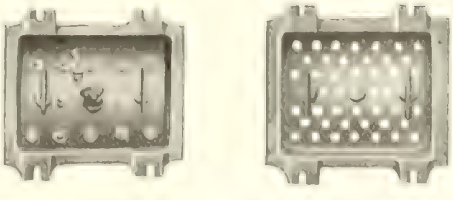

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Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; tapestry brick, $20 to $30; sand-lime brick, $7.60; King Edward Siding; $6.50 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$3.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 57c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 67c, per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals). Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 57c per gal. of 9 lbs. Raw linseed oil—in barrels, 54c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del. South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
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BAR STEEL

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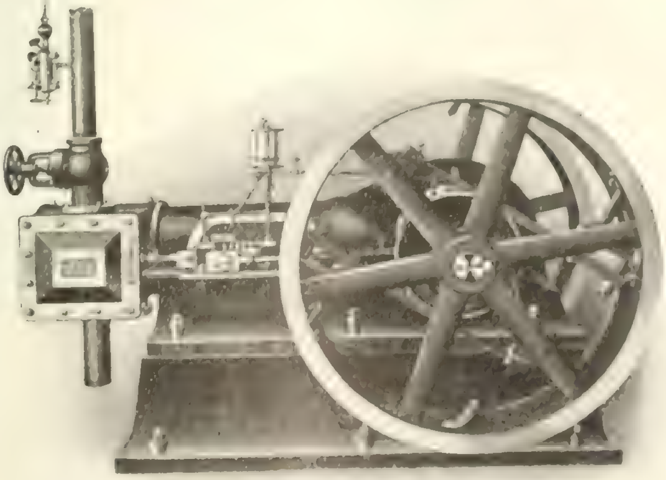
Victor Centre Crank, High Speed Automatic Engines



Suitable for belt drive or direct connection to electric generator. The Frames are of heavy duty enclosed type. Crosshead guides are of the bored type. Crank shaft is made from a solid forging. Balanced ring slide valves are used on all sizes. This is one of the strongest points of the Engine. Maximum speed regulation is obtained by the Hardwick Patent Governor. Lubrication is from a large central reservoir with sight feed showing the exact amount of oil fed to each point of the Engine. The finish and workmanship is of the best.

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HERRINGBONE COPPER ALLOY LATH

The "No Increase In Price" Policy

Herringbone Copper Alloy Lath, gauge for gauge, will resist hard wall plaster corrosion sixty-one percent better than lath made from ordinary steel. In other words ordinary metal lath would have to weigh sixty-one percent more than Herringbone Copper Alloy lath in order to be equally efficient. This means it would have to cost about fifty percent more in order to compete with copper alloy quality.

Yet when Herringbone Metal Lath was changed from ordinary steel to copper alloy the old price to the consumer was not changed. Same price—sixty-one percent more quality. At first glance it would appear that the management here lost a great opportunity.

We believe that in adopting this generous policy we have gained, instead of lost, an opportunity. For even before Herringbone lath was made of copper alloy its superior stiffness, selvage edge, and plaster saving qualities made it the standard specification. And now, with this final improvement in quality and the price unchanged, its superiority is absolutely unasailable. Every thinking man will use Herringbone Copper Alloy Lath now.

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PONTOONS
and other similar works

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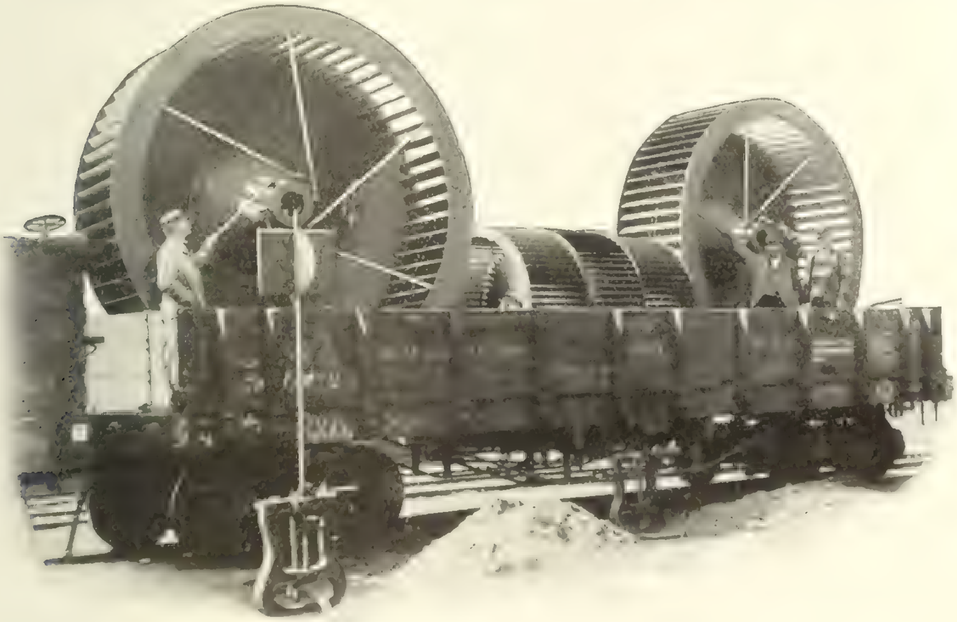

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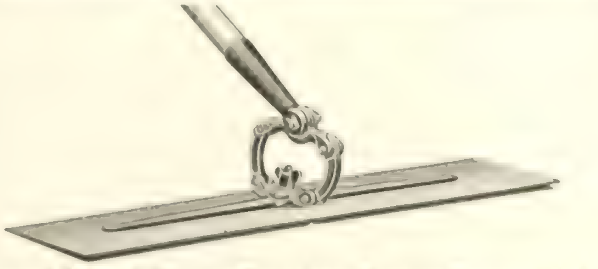

"Abram" Sidewalk Finishing Tools are sold on the **Guarantee** that **ONE MAN** can do more work with them than **THREE MEN** can do with ordinary tools. This means, if Finishers get $4.00 per day, you save the wages of **TWO MEN** or $8.00 per day by using **"Abram"** Tools. We positively guarantee this result. Let us prove it to you. Circular.

ABRAM CEMENT TOOL CO. 105 Ouellette Ave
WINDSOR, ONT.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68)

LUMBER (BUILDING MATERIAL)

(5 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38, 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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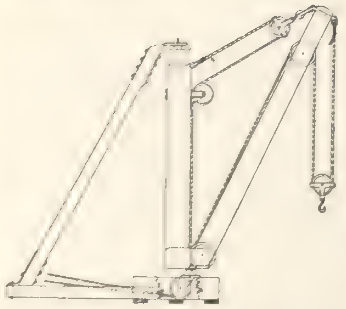

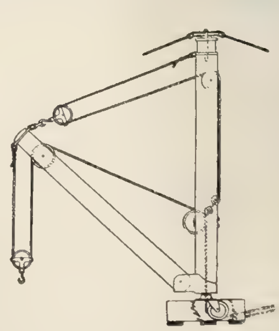

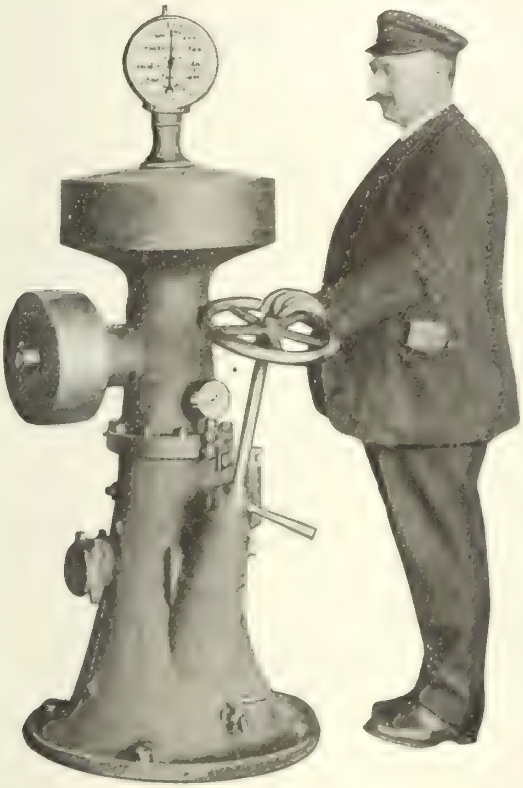

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Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

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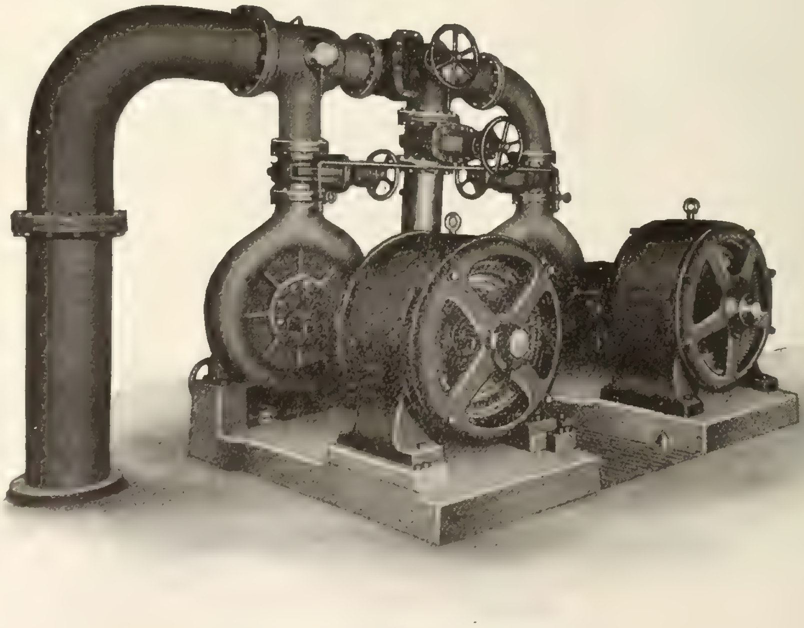

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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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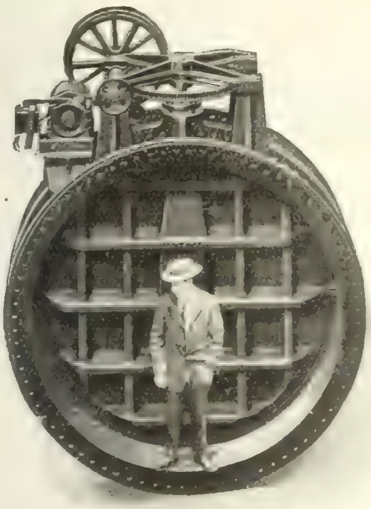

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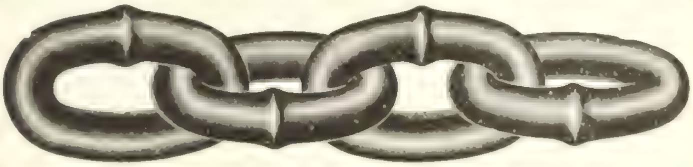

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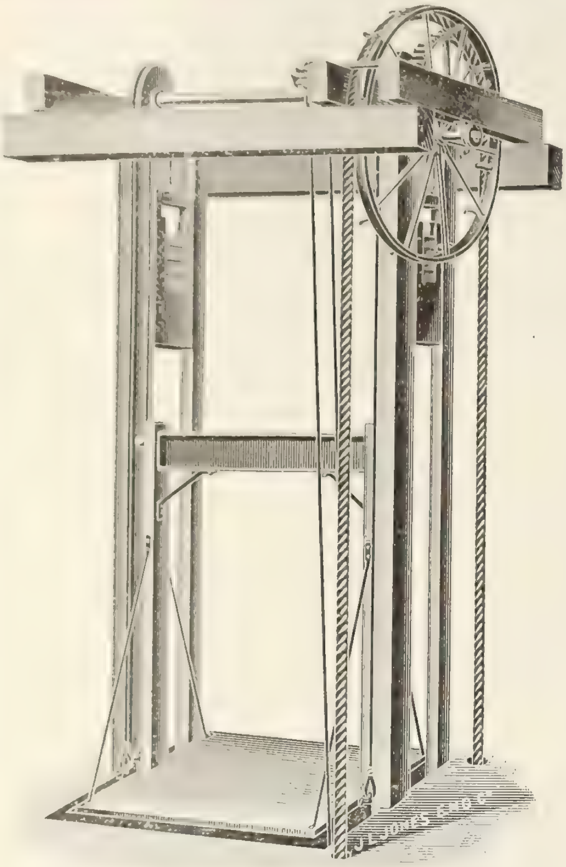

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Passenger
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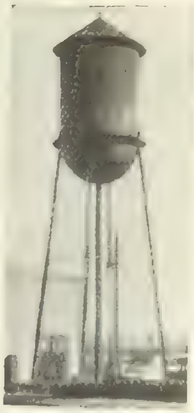

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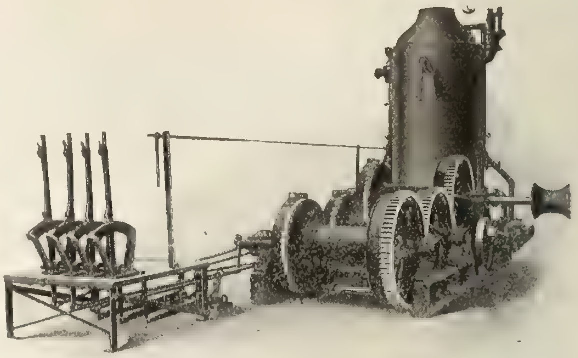

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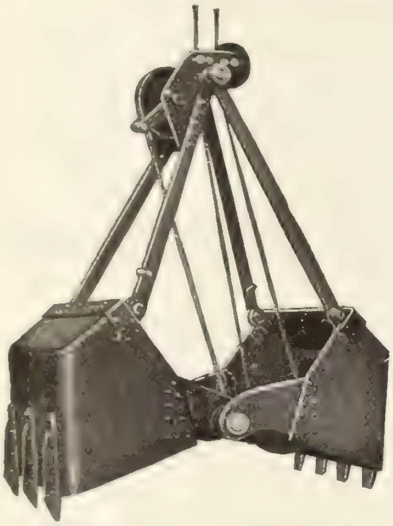

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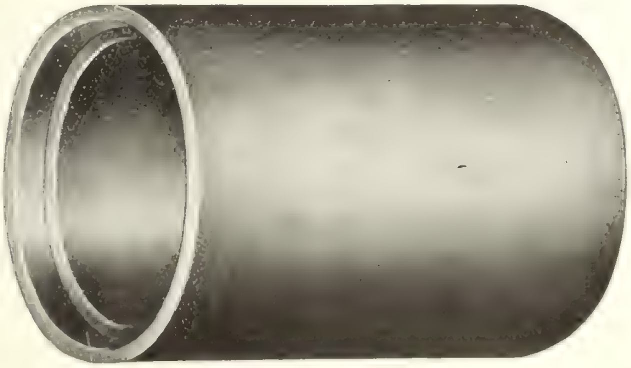
properly built of properly made

Reinforced Concrete Pipe
LAST FOREVER.



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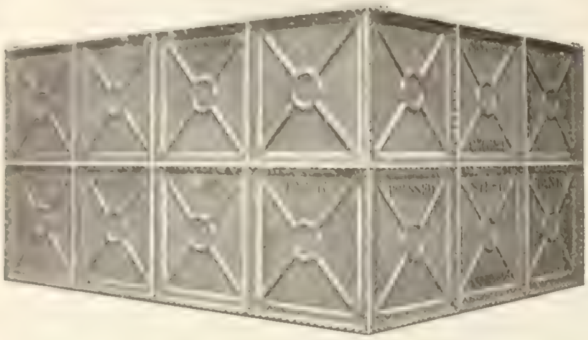

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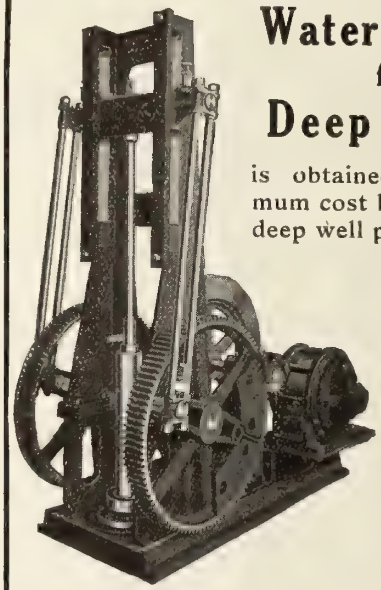

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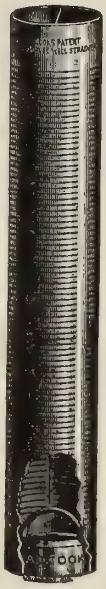

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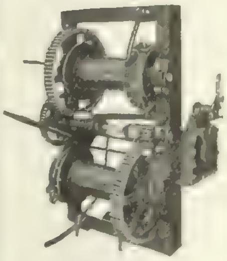
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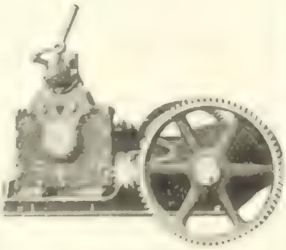
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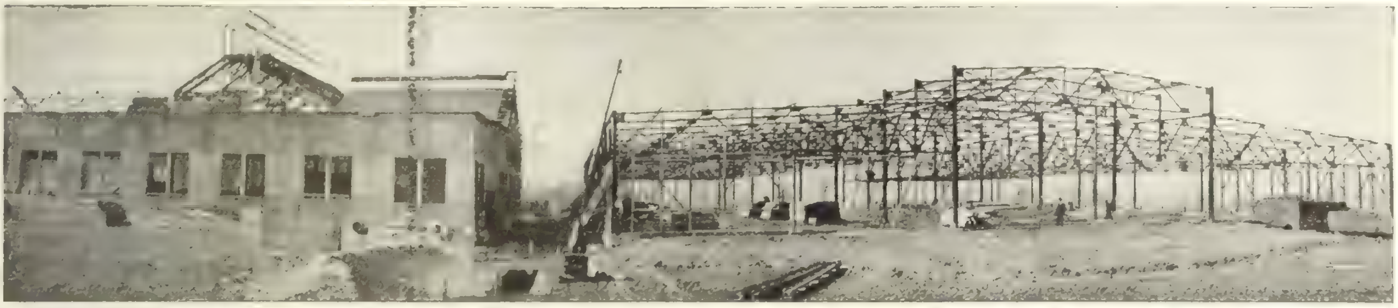

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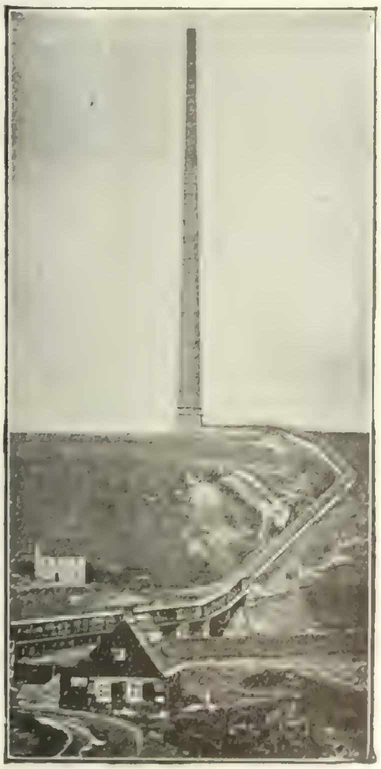

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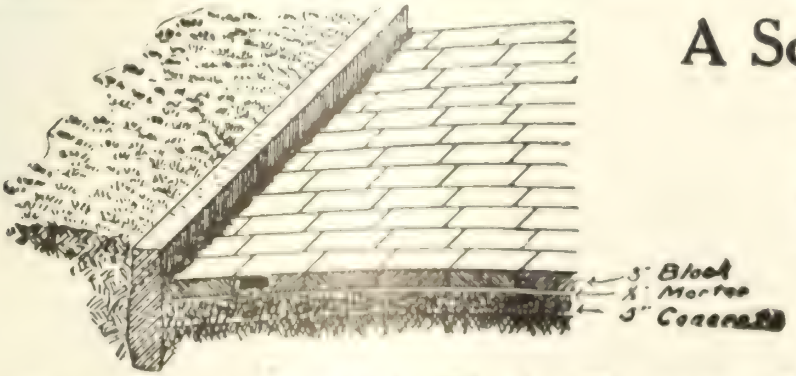

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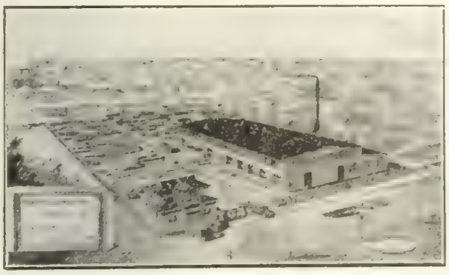

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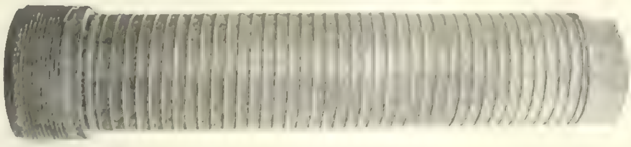

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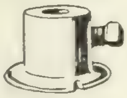

Fig. 1

Fig. 2

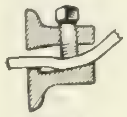

Fig. 3

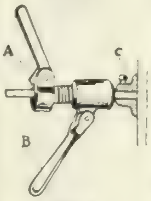

Fig. 4

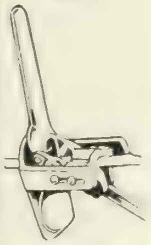

Fig. 5

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Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding form together. The rod will break before the clamp will come off either end.

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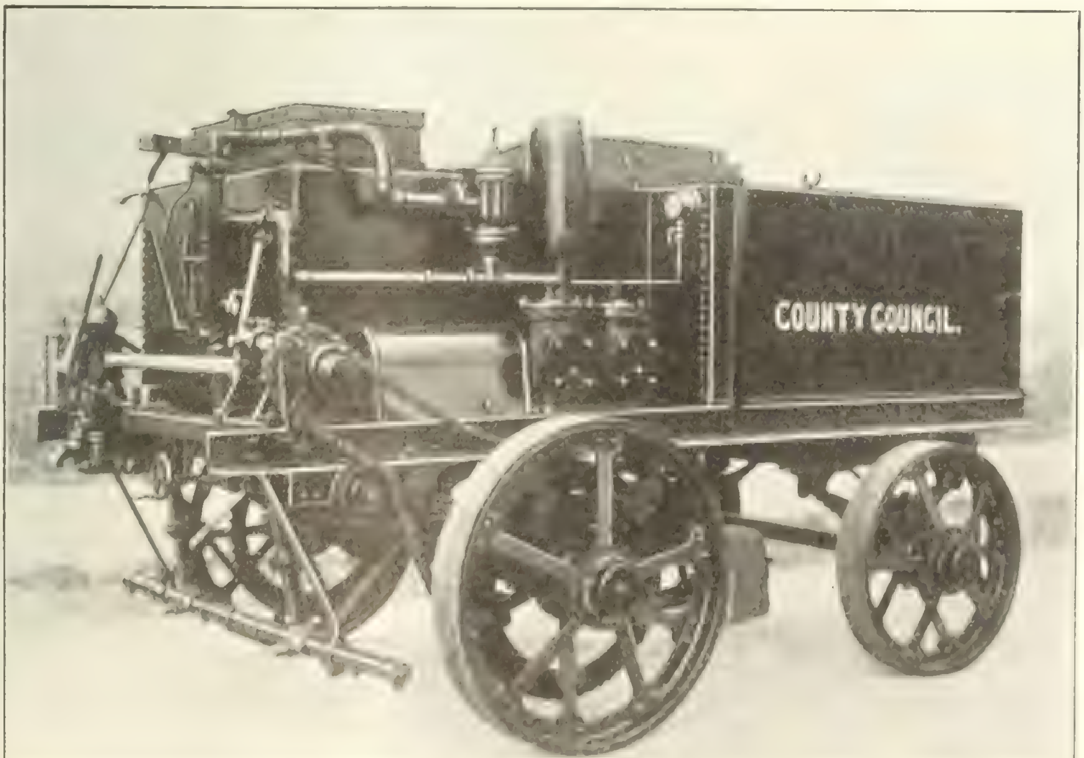

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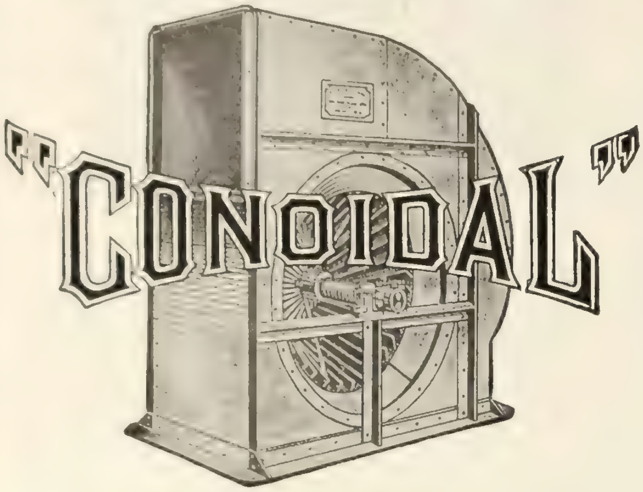

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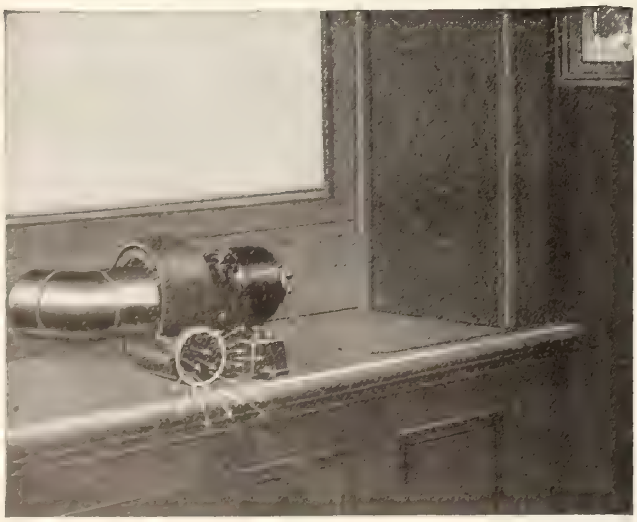

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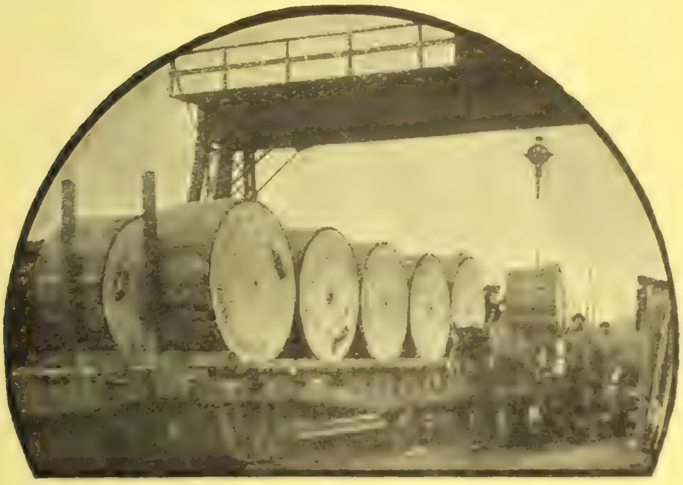

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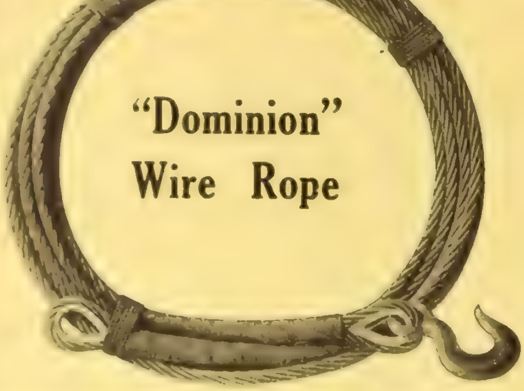

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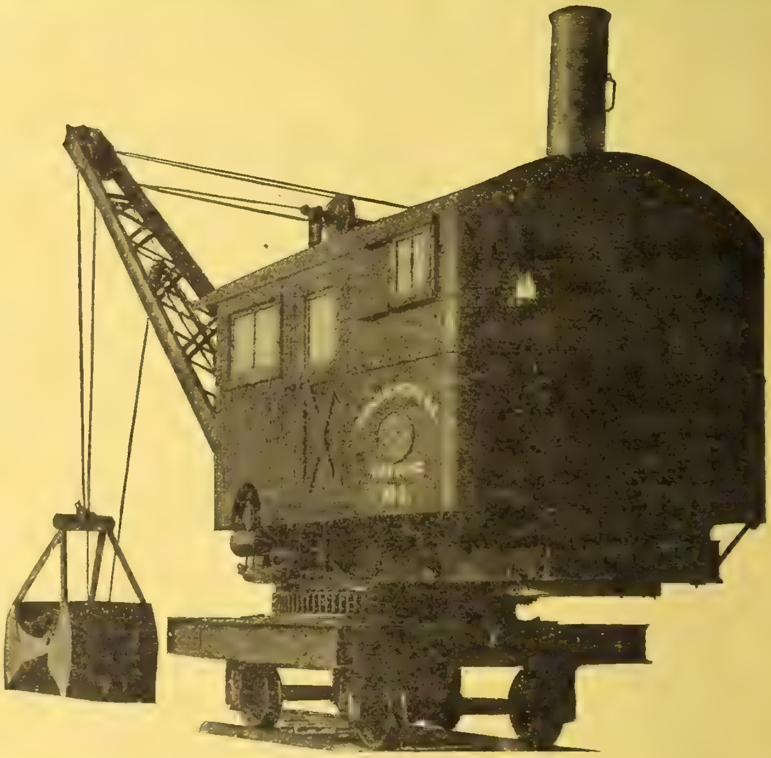

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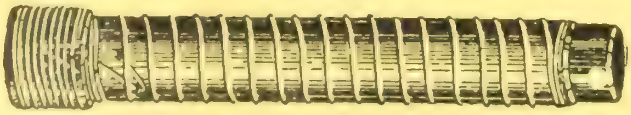

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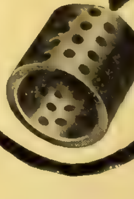

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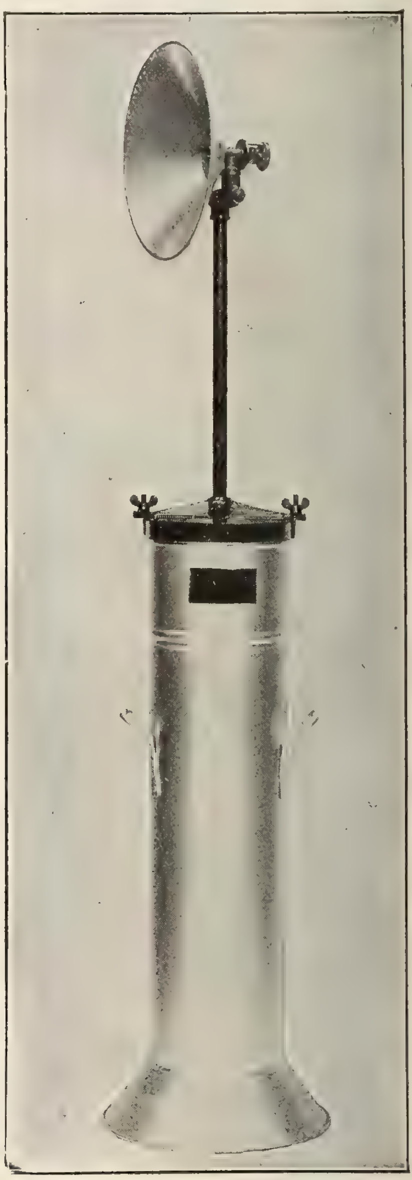

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Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
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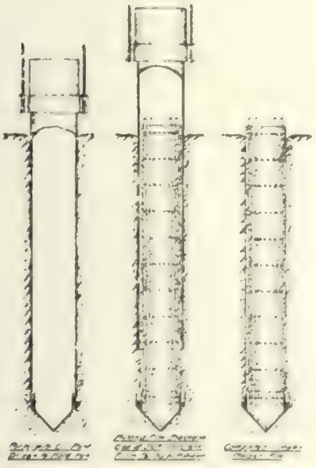
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Simplex Piles For Difficult Foundations



The Simplex Moulded Pile

The Simplex Molded Pile for foundations for docks, wharves, sea-walls, etc., or for foundations through wet peat, or where very soft conditions prevail. The Standard Simplex form with the Cast Iron Point is driven to the required penetration as in the Standard System. A small quantity of soft concrete is introduced through the form, and on this as a bed, a molded reinforced concrete pile is lowered through the form, which is then withdrawn leaving the molded pile in position.

FOR the problematic foundation work of docks, wharves, breakwaters and other water work, or foundations through wet peat or where very soft boggy conditions prevail Simplex concrete piles will be found the best solution.

The Simplex Moulded Inserted Pile overcomes the many objections of jetting and gives a rigid and nonsettling foundation that is everlasting.

Not only is a Simplex Piling foundation permanent but it is also a rapidly made foundation.

Simplex moulded piles are cast either vertically or horizontally in heavy wooden or metal forms, insuring straigtness and uniformity of diameter. Any desired reinforcement that conditions require may be used.

Send for our Concrete Piling Book.

Test on one Simplex Molded Inserted Concrete Pile at Harbor Commissioners' Elevator No. 2 Annex: Load was 50 tons. Total settlement 3-16 of an in.

Simplex Concrete Piling Company of Philadelphia

CANADIAN REPRESENTATIVES:

Simplex Construction Company, Limited

Coristine Building, MONTREAL

MUELLER

Water, Plumbing and Gas Brass Goods

Made in Canada by Canadian Workmen at Sarnia

And used everywhere throughout the Dominion by the most particular water works, gas works and plumbing trades.

The Mueller Line includes

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- Curb Cocks
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- Stop and Waste Cocks
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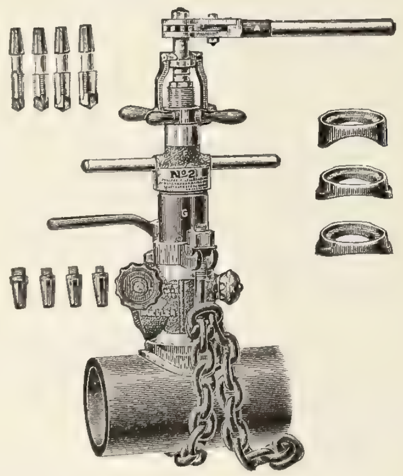
- Basin Cocks



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- Service Boxes
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All Mueller Goods bear the name MUELLER, are tested under two hundred pounds hydraulic pressure and are backed by our Unconditional Guarantee.

Users of Mueller goods have the greatest satisfaction and service and the least trouble. You should adopt them. Clip and mail the coupon for a complete catalogue and get acquainted with this splended line of dependable goods.

C. R.

H. Mueller Mfg. Co. Ltd.
Sarnia, Ont.

Send me your D Catalog showing complete line of goods.

Signed ....

City.................. Prov..................

H. Mueller Mfg. Co., Limited

Sarnia, Ontario

Makers of High Grade Water, Plumbing and Gas Brass Goods

Wells and Gray, Limited

Engineers and Contractors

Ford Motor Co. Factory, Ford, Ont.

This cut shows building under construction at present time. This building is approximately 175 feet square and is to be 6 storeys in height. In the back ground are seen buildings previously built by us.

Wells and Gray, Limited

247 Confederation Life Bldg., Toronto, Ont.
Branch Office: Royal Bank Bldg., Windsor, Ont

Hy-tex

The Standard of Quality in Brick

Hy-tex is not a name that applies alone to the Ironspot brick with which the residence pictured below is faced. It is not a name that denotes any *one* texture, or any *one* color-range. The name "**Hy-tex**" stands for *all* the face brick manufactured by the Hydraulic-Press Brick Company. That means every color and every texture of face brick known to the art of burning clay.

You owe it to yourself to know **Hy-tex,** and to recognize that it is simply a word to make it easy for you to *specify* QUALITY and RESPONSIBLE SERVICE in any kind or color of face brick that your taste may dictate.

Ask any of the following agents to show you **Hy-tex** Brick, or write us for complete information. Ask us to send you one of the most helpful books that any architect or contractor can possibly have, "The Hy-tex House of Moderate Cost."

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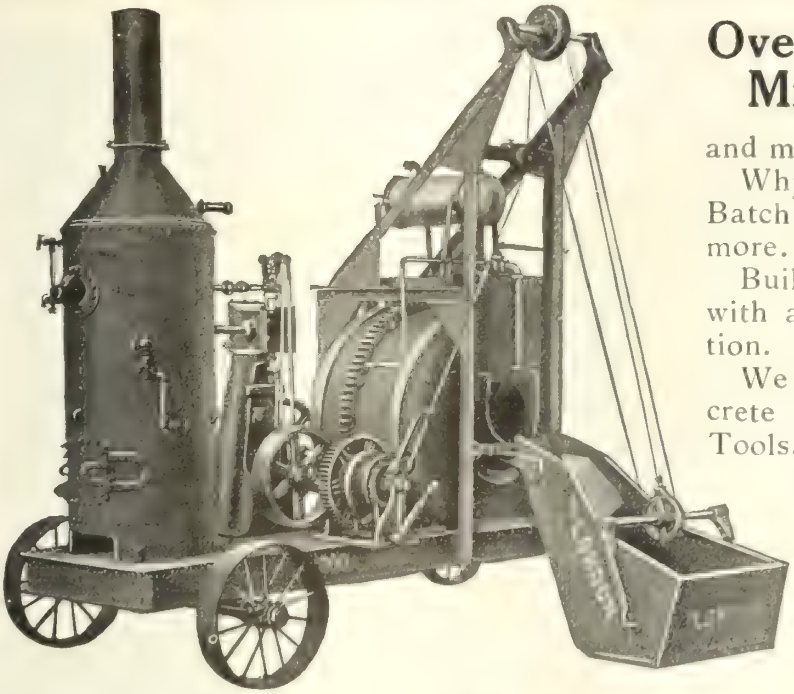
LARGEST MANUFACTURERS OF FACE BRICK IN THE WORLD

Residence at Hamilton, Ont.,
Faced with Hy-tex Ironspots
Nos. 40
and 43



Over 1200 London Concrete Mixers in Use in Canada

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Why so many? Because every London Batch Mixer in use means the sale of ten more.

Built in twenty-three different sizes and with any equipment. All steel construction. Built to last a life time.

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We are the Largest Manufacturers of Concrete Machinery in Canada.

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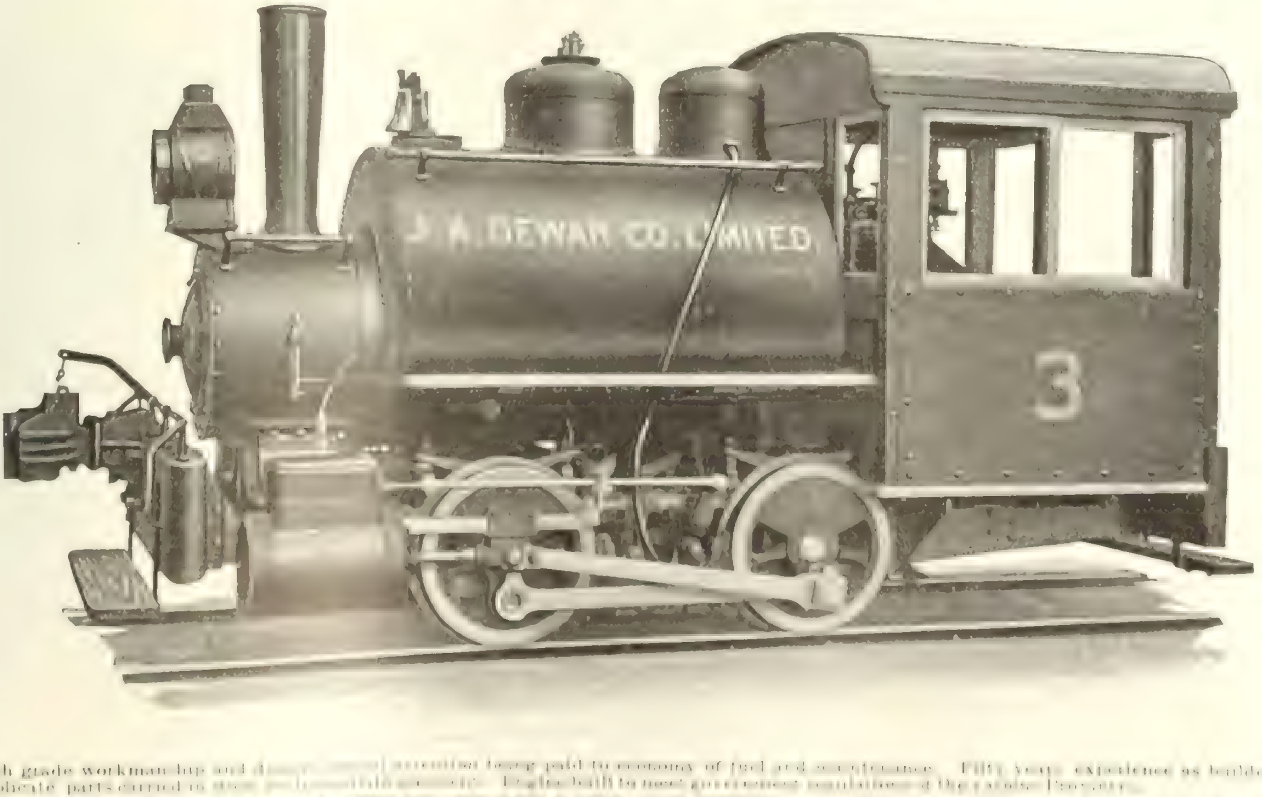

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years' experience as builders. Duplicate parts carried in stock [illegible]. Engines built to meet government regulations of the various Provinces.

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(Continued on Page 14)

G & G TELESCOPIC HOIST (PATENTED)

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
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7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

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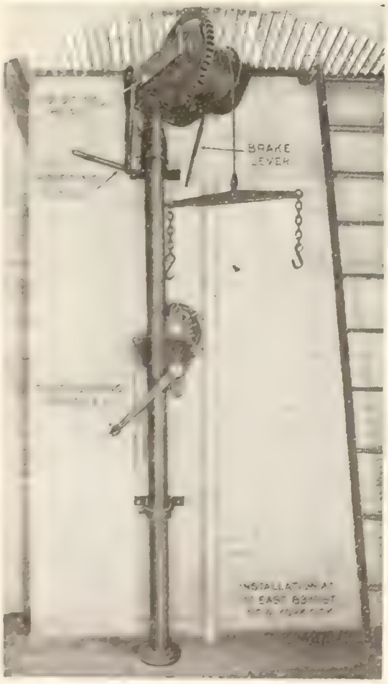

Compact—easy to erect. Takes up no room in basement.

Hoisting head revolves. Can is deposite on Sidewalk without lifting.

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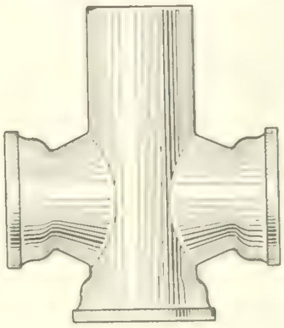
Warren

Cast Iron Pipe



Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

Large stocks always carried on hand.
Prompt shipments.

Warren Foundry
and Machine Co.
11 Broadway - NEW YORK

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of teriffic usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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(Continued on page 16)

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Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron
Plain Black Iron
Galvanized Iron
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Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

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Sarnia, Canada

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

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"Superior Graphite Paint"

For the Protection of Steel

Is used so largely because it has behind it a successful reputation of 25 years. Its use insures either exposed or enclosed surfaces, against rust.

Leading ENGINEERS and ARCHITECTS specify "Superior Graphite Paint" for all metal work because for similar work it has shown ACTUAL PROVEN MERIT.

Write for new booklet on PROTECTING STEEL STRUCTURES, and for full information to

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Wrenches
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Tarvia

Preserves Roads
Prevents Dust~

Main Street, Dutton, Ont.
Constructed with Tarvia
Modern Pavement.

We didn't write this advertisement—

THE man who wrote this advertisement didn't know he was writing one. He simply stated facts in a letter, which we copy in full:

Dutton, Ont., July 30th, 1914.

Dear Sirs:

For many years considerable money was annually expended on Main Street in the Village of Dutton with very unsatisfactory results. The road was never good and at some seasons of the year it was almost impassable. In 1912 the Council decided to undertake work of a more permanent character.

After careful consideration it was decided to use vitrified brick for ten feet on each side, forming a gutter, and for the centre of the road crushed stone with Tarvia as a binder. The result is everything that [illegible]. [illegible] test has fully convinced us that the outlay has been one of the very best investments the Village has ever made. The road throughout is in as good condition as when the work was completed, if not better. We have one of the best streets in Ontario.

Yours truly,
J. H. McIntyre, Reeve.

Tarvia is a coal tar product, very dense, tough, plastic and [illegible]. When used as a binder in ordinary macadam it makes the road dust-proof, mud-proof, automobile-proof, water-proof. The saving in maintenance exceeds the extra expense for construction with Tarvia. Big towns use Tarvia for handsome boulevards for the sake of abolishing dust. Little towns use it for streets and roads on account of its economy.

Booklets on request. Address our nearest office.

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Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

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Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders

BRICK PLANTS

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Clay, Slag,

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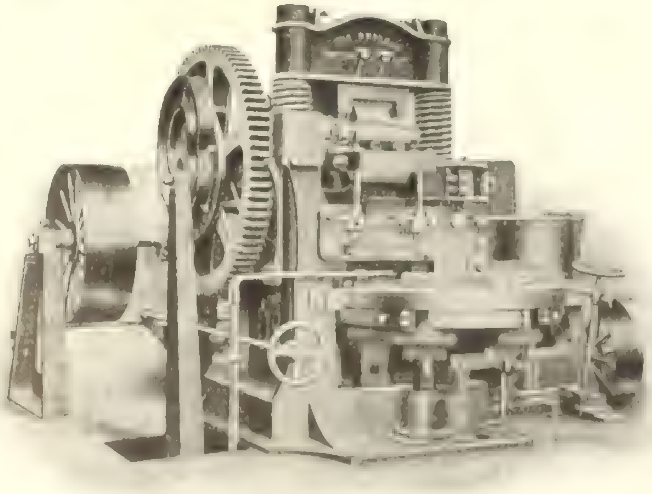

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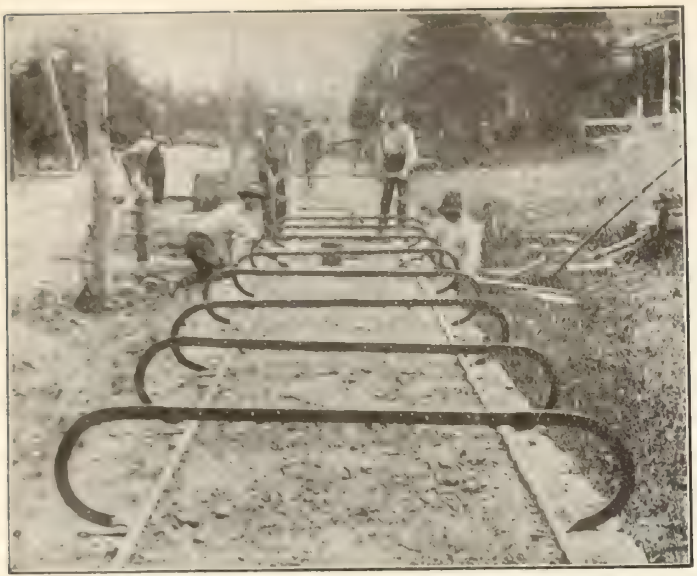

Malone "Complete Finish"
Steel Concrete Sidewalk Forms

Eliminate lumber costs, reduce labor expense. Continuous and complete operation in furnishing, removing and replacing. Adaptable to any surface conditions. Adjustable to any width. Indestructible and independent of any weather conditions.

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Write for prices and particulars.

SWANSEA
Salt Glazed and Vitrified
SEWER PIPES

True to Size.
Impervious to Water.
Sizes manufactured and always in stock 4 in. to 24 in.

Ask for Price List and Discounts.

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Chimney Tops
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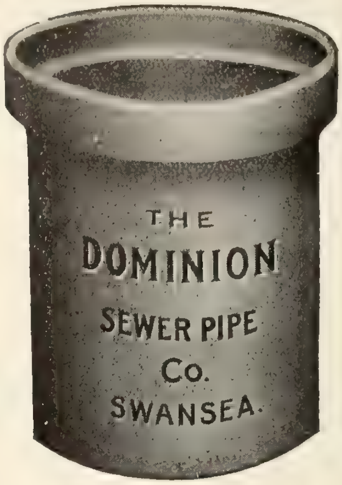


The Dominion Sewer Pipe Co.
(The Independent Co.) Limited
SWANSEA (near Toronto)

The Thew Steam Shovel Will Save You Time, Trouble and Money

The use of a Thew Automatic Steam Shovel will effect an immense saving in labor.

The output is limited only by the facilities provided to cart it away.

The Type O Thew shown in the cut loaded 1,965 cu. yds. in 7 ten-hour days.

Another Type O Thew in a 6 ft. cut averaged 578 cu. yds. during the month of April.

Another Type O Thew in a gravel pit loaded 5,182 cu. yds. in 7½ ten-hour days—an average of 76 cu. yds. per hour.

Another Type O in a 15-inch cut averaged 314 lineal feet, amounting to 292 cu. yds. per 9-hour day for 23 days.

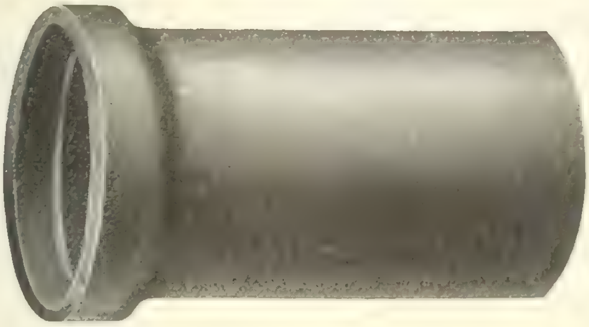
Another Type O in a 10-inch cut excavated 1,788 lineal feet in 6 ten-hour days—amounting to 1,455 cu. yds.—an average of 242 cu. yds. per 10-hour day.

USE A THEW—IT PAYS.

Write for Catalogue and Full Information.

Type O Thew on Road Grading

The Thew Automatic Shovel Company, - Lorain, Ohio



Sewer Pipes

High Grade Salt Glazed Vitrified Sewer Pipes and connections are a specialty with us. We also manufacture culvert pipes, inverts, flue linings, stove linings, fire bricks, locomotive blocks, gulley traps, range bricks, cupola linings, wall coping and all kinds of vitrified and fire clay goods. Prompt shipments on all goods.

Vitrified Hollow Building Blocks

"MADE IN CANADA"

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ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

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VITRIFIED AND SALT-GLAZED

IS,

By Actual Tests Made This Year in Kansas City, Mo.,

The Superior of Nearly Every Brand of Sewer Pipe Made on This Continent

It is something to know that you are not making a sacrifice for sentiment's sake when purchasing sewer pipe

MADE IN CANADA

You are getting an article that stands a 20% stronger test in all departments than the average of 26 different American makes.

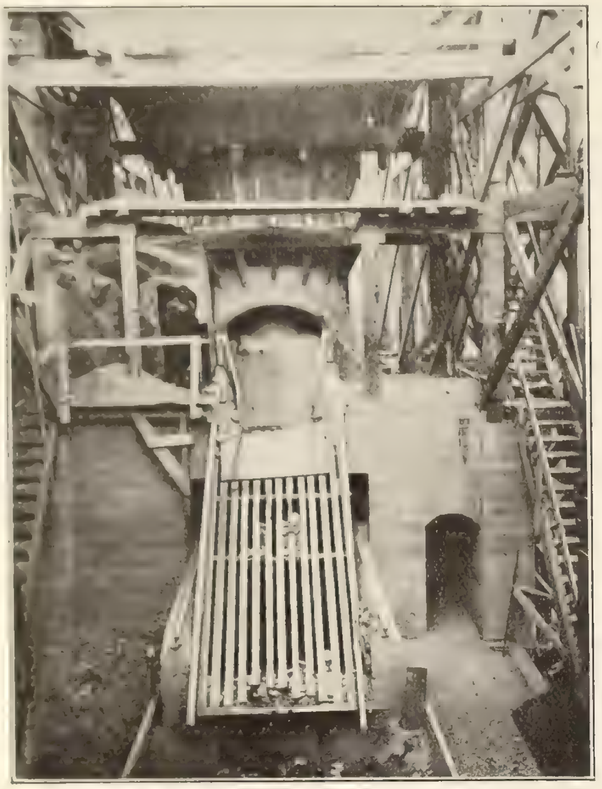
WAR CONDITIONS

Have caused our Yankee Cousins to court this market strongly. They make "pretty" ware but,—well, sewer pipe is neither bought nor sold for mantle-piece decorations

You Get the STRONGEST PIPE and the QUICKEST SERVICE from

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.



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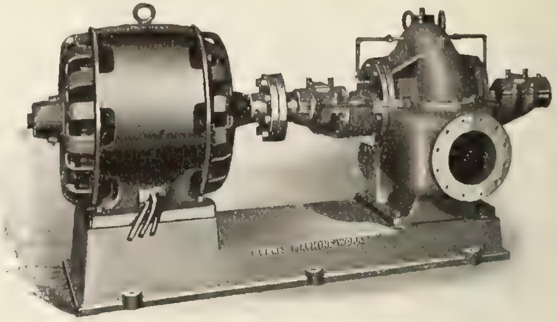
Prompt Delivery
Rogers Supply Company, Limited
28 King St. W. TORONTO



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For motor or steam turbine drive, are very popular with pump users due to their efficiency and accessibility.

We also build the well known
MORRIS SAND AND CONTRACTORS' PUMPS

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TORONTO, CANADA

We build all kinds of Cranes for
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ELECTRIC POWER
STEAM POWER

Brickmaking Machinery
Complete Outfits for Brickmakers

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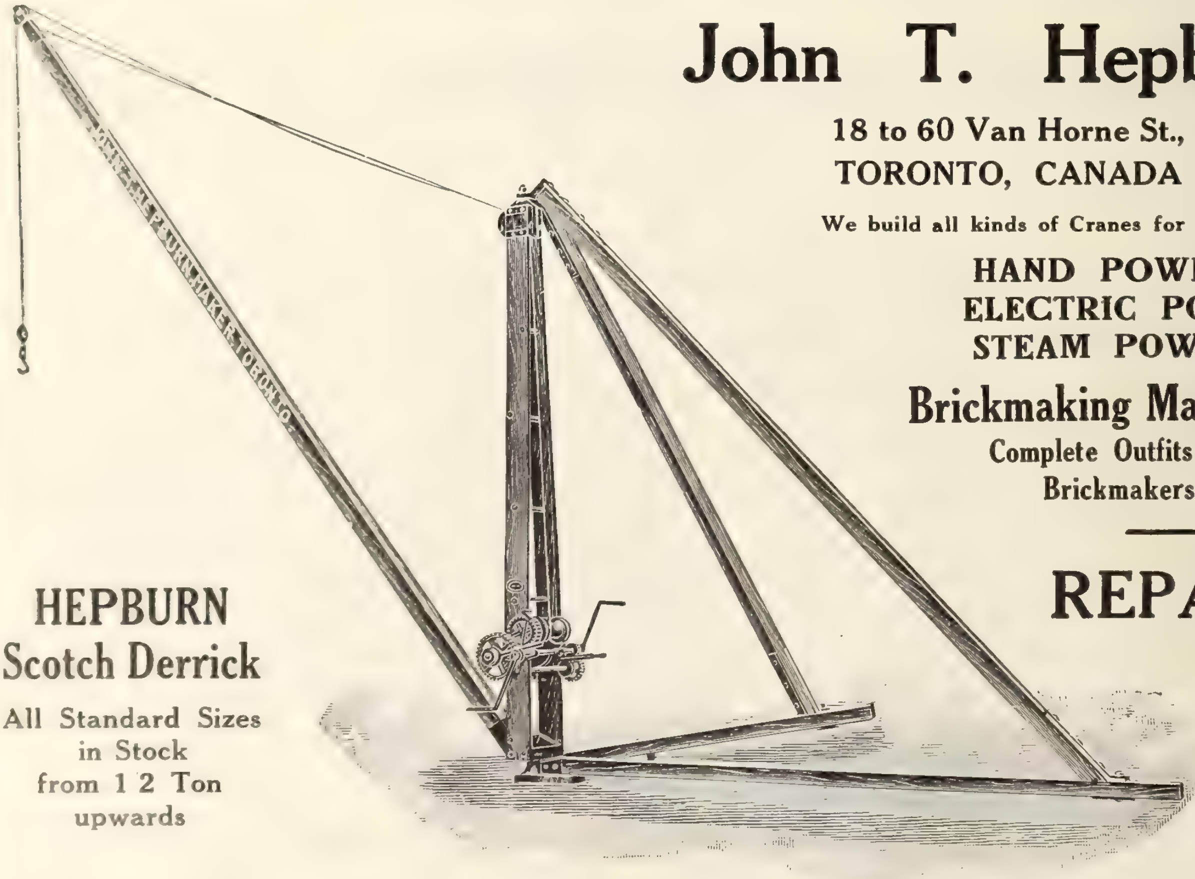
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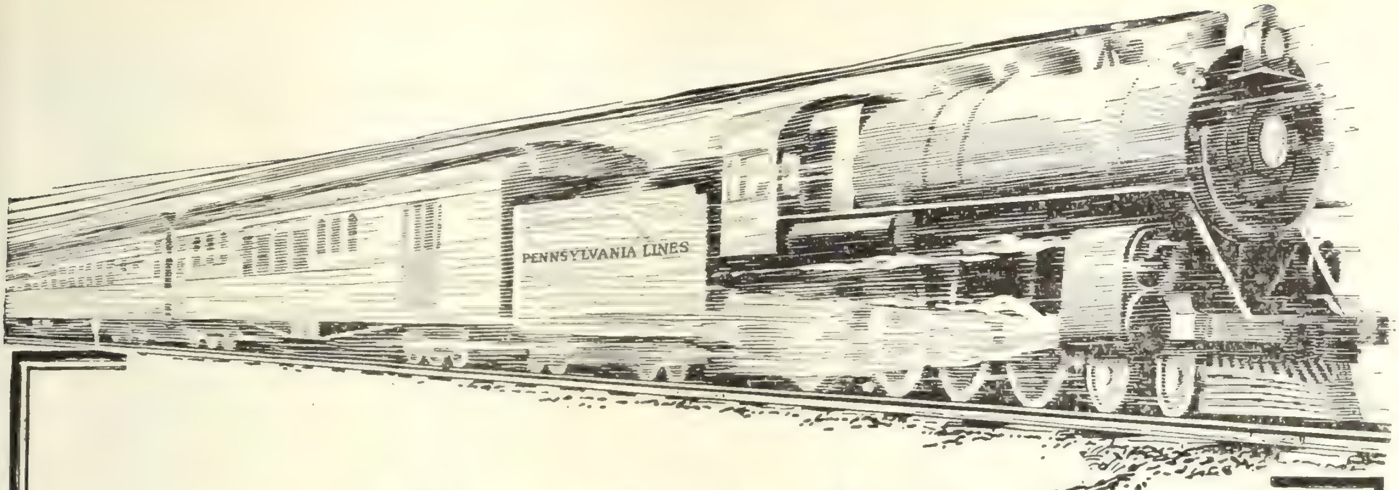
All Standard Sizes in Stock from 1 2 Ton upwards

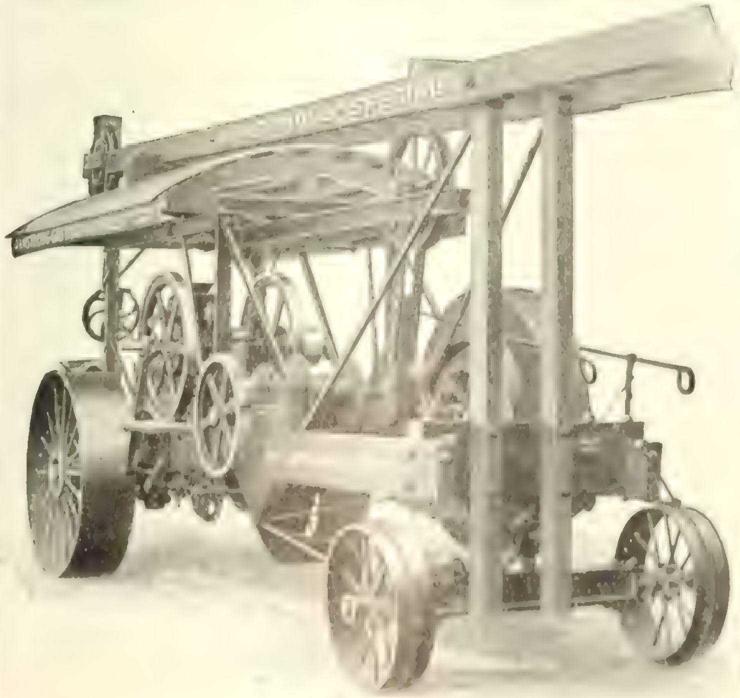


When Time Is Money You Take the Limited—Not the Local

Buy an Armstrong Special Blast Hole Drill. It works faster, makes fewer stops, and saves *your* time. Time means *money to you.* Saves time because it drills more hole in a given time than any other cable drill—this is due to a special spudding beam and motion which allows both for longer strokes and a greater number. Each stroke is unhampered, due to the free fall which the Armstrong Special allows the string of tools. There are fewer stops because the Armstrong Special is designed for rock drilling alone and repairs and breakage are practically eliminated. The maintenance cost is lowered because the whipping of the cable is eliminated.

Armstrong machines are equipped with our powerful gasoline engines, made in our own factory, which are especially designed for this machine to give continuous and rapid operation. They are built with the idea that the operator is there to watch the drilling and not the engine.

We could not afford to give you our guarantee nor put our name on the machine if the Armstrong Special would not deliver all that we claim and more.



Guarantee

We guarantee the Armstrong Special Blast Hole Drill to drill more hole in a given time than any other cable drill on the market, and we will write this in every sale contract we make.

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MFG. CO. WATERLOO, IOWA U.S.A.
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SINCE 1867

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New York City

Western Branch:
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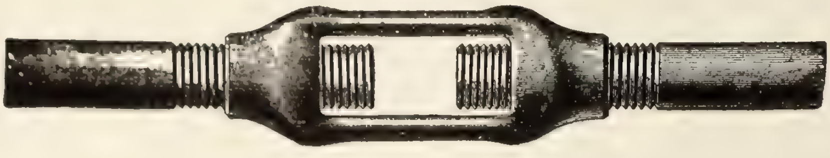

B TRADE MARK

B TRADE MARK

Full line of steel specialties for Contractors and Builders

Welland, Ontario

MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
3—Exposure to sun and air will not cause its deterioration.
4—It has great cohesive strength.
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6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

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SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

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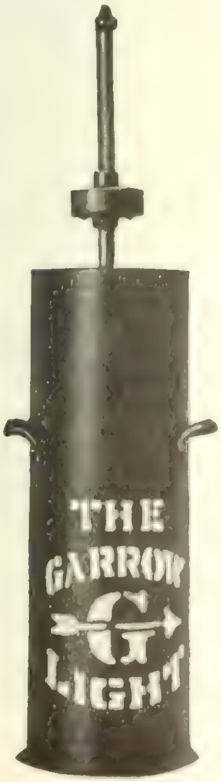
Branches Everywhere



$45. GARROW
Contractors' Acetylene
Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts [illegible] gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction &
Machinery Co., Ltd.
Sudbury, Ont.

Warehouse
Space To Let

5 Floors of This New Building, For Office and Warehouse Use.
Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
One block from four car lines
Floor area, 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
437 Adelaide St. West, Toronto
Phone Adelaide 2700

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There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., LTD.
Leicester, England

KERR

Gate Valves
and
Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship, to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Calalogue No. 5.

The Kerr Engine Co., Limited
WALKERVILLE, ONTARIO

CERESIT WATERPROOFING CO.

Gentlemen:—In reply to yours of the 18th inst. will say that we have used CERESIT Waterproofing in the foundations of a large warehouse and in the erection of a Power Plant. In both cases the CERESIT was used in the mass of concrete and we have found it to give perfect satisfaction. Yours very truly,

R. F. WILSON & CO.
Per R. F. Wilson

PERFECT SATISFACTION

CERESIT
TRADE MARK

Ceresit gives perfect satisfaction wherever used. It has given hundreds of other contractors perfect satisfaction—and can do the same for you. Try it. Write for the 1914 "Book of Evidence" which tells the complete story.

"MADE IN AMERICA"

CERESIT WATERPROOFING CO.

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Results of 3,000 Tests
on Rail-Steel Reinforcing Bars

The American Society for Testing Materials appointed a Committee to investigate the merits of rail steel reinforcing bars.

Under the direction of Professor W. K. Hatt, of Purdue University, 2,036 samples were collected between September, 1912, and February, 1913.

Upon these samples 2,983 tests were made. The samples were gathered unexpectedly from the mills and represented true working conditions.

In Professor Hatt's report to the Society the following outstanding features are commented upon:—

1. The rail steel showed an excess ductility for its strength above the usual grades of steel.

2. 97 per cent. of the plain and deformed bars under ¾-inch bent cold to 180 degrees, and 97.6 per cent. of the bars ¾-inch and over bent cold to 90 degrees.

3. **The material showed remarkable uniformity**, as 80 per cent. of the bars did not vary more than 12 per cent. from the mean tensile strength. (Professor Hatt says that the variability of high carbon billet steel used for reinforcing bars should be known for comparison, but unfortunately no such data was available). The variability of 12 per cent. in the mean strength compares favorably with the specification limits of from 55,000 to 70,000 pounds per square inch set for the tensile strength of structural steel reinforcing.

4. Professor Hatt says that it was apparent that the process of manufacture had **raised the mechanical quality of the material.** In this connection, it must be remembered that the material to begin with was of the best, as rails, of course, are always made of the highest grade steel.

We would be pleased to submit a complete copy of Professor Hatt's report and to go into the whole subject in great detail with any engineer, architect or contractor who may desire further information.

Burlington Steel Co., Limited, Hamilton

Manufacturers of Rounds, Squares, Flats, Twisted Squares, Angles, Channels
T-Bars, Ovals, Half Ovals, Half Rounds, Bands and Special Sections

Cement floors of Toronto (John St.) Pumping Station treated with Toch Bros. Cement Filler and Floor Paint.

Buy "MADE IN CANADA" Products

TOCH BROTHERS "CEMENT FILLER" and "CEMENT FLOOR PAINT"

As Used In

Power Houses; Hospitals; Garages; Storage Warehouses; Office Buildings; Residences, Etc.

These materials prevent the dusting and powdering of cement floors, which is the cause of so much disintegration and render floors impervious to the action of water, oil or grease.

Write for Illustrated Booklet

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Factory:
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Can. Equipment & Supply Co., Ltd., Calgary and Edmonton

The Marvel of the Age

"The right material—the perfect brick."

School Building, L'Epiphanie, Que.
Architects—Viau & Venne, Montreal.

Made in Canada by Canadians for Canadians.

This building is faced on all sides with grey concrete brick, trimmed with red.

EVERLASTING CONCRETE BRICK — Obtainable in any color from black to white. Waterproof! Hardens with age! Fireproof!

National Builders' Supply & Enamel Concrete Brick Co., Limited

Montreal Office: 30 St. Francois Xavier St. **Plant: Mascouche, Que.**

Equipment for Out-o'-Way Places

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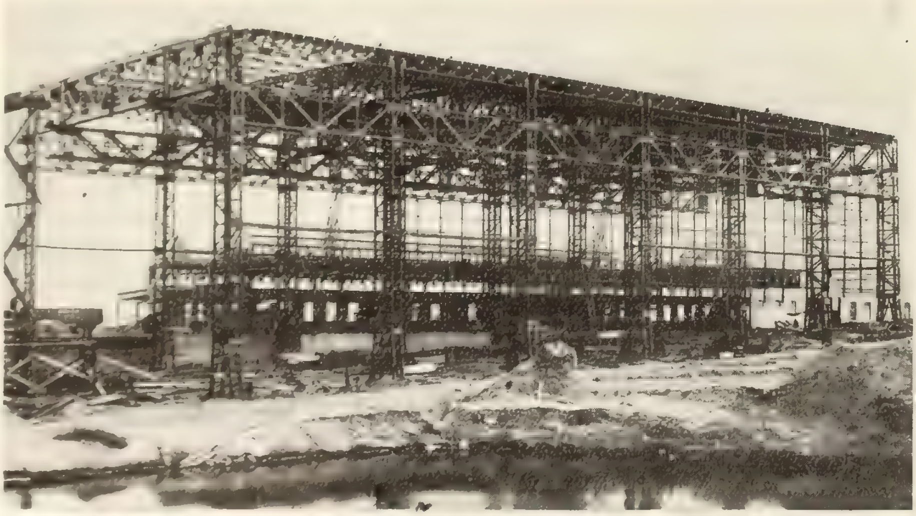

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The Building Owner as a Gambler

IN view of the falling off in constructional activity it may appear ill-timed to refer to the gambling propensities of the building-owner, but in reality, in our opinion at any rate, there could not be a better time to take up such questions, as it is during the lull in construction that contractors are enabled to sound their depths.

The rank uncertainty of the present method of estimating continues to occupy the attention of the architectural and building fraternity and of those owners who do not seek to beat the contractor and material men. Referring to the lamentable conditions existing, a correspondent of "The Quantity Surveyor," when voicing his opinions in reference to certain owners' well-known attitude of "heads I win, tails you lose," thinks this is the fundamental difficulty we have to contend with.

It certainly seems difficult to demonstrate to some owners how a straight and accurate bill of quantities to estimate upon helps them to get better work, a square deal, and a satisfied contractor. It is the experience of those who have long been engaged in the practical advocacy of the quantity system to find that, although the average owner will strenuously deny trying to get "something for nothing" out of a contractor, they, for the most part, really do this very thing. They will hire a certain type of architect, not altogether for his talent as an artist, but for the purpose of helping them get the best of the contractor. This is attempted robbery, from whichever way we may look at it. Can we wonder if, in self-protection, the contractor retaliates?

Such owners appear to argue in their own minds something like this: "I (the owner), holding a pack of marked cards, to be used after a contract is signed, must first put a number of bidders to work "gambling" with each other to see who shall have the privilege (?) of playing with me in the final. My standing in the community must be taken by the winner as a sufficient assurance that we two, when we play, will play a square game, whatever the previous players may have done between themselves. I (the owner) know something of the building business, and doubt if this contractor fellow knows enough to get ahead of me and my architect, and he surely will not think to keep a few cards up his sleeve! Even if he does, he cannot always select the right cards, because he will forget that I am already fixed so as to take most of the tricks any way, and so the game will be played almost as I direct. Suppose by chance my tricks are trumped too often and I am likely to lose. Is not the referee under the contract in my employ? What do I pay him for? He must protect me, for am I not the owner? I must not let my adversary win, notwithstanding his money is invested in my building and regardless of his practical knowledge, which must also be used to my advantage. Besides, I do not have to play the game every day. The next time I do I will look out for a different man—one belonging to my fraternity, one just starting in business and anxious to please preferred."

And this is how the building game is too often played. Common custom and convention compels a certain type among the unprivileged class of architects (those who are not altogether financially independent of clients) to follow those methods which lead to possible future business. That is but human nature, and the human element of self-interest is more often than not apparent. But if a clear detailed bill of quantities is once made the basis of the contract—to [illegible] labor and material for so much money and no more (and no less)—then it will help to relieve the other and better type of architects, who do try to be fair to both contractor and owner, from embarrassing positions and decisions, and from otherwise acting in judicial capacities under building contracts, and which often accounts for the loss to them of business friends and ultimate loss of professional practice.

Engineering Topics In The Old Land

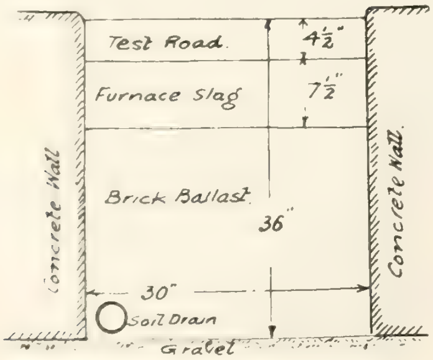
An Interesting Action Involving Road Work—Road Tests—The German "Siege Gun Platforms"—Competitive Appointments

By the London, Eng., Correspondent of the Contract Record

An action of considerable interest to local authorities and of the greatest possible interest to at least one firm of manufacturers is in progress at the High Courts of Justice. The Gas, Light and Coke Company ask for injunctions to restrain the Woodford and the Wanstead Urban District Councils from repairing roads in their districts with reinforced concrete. The reason of the action is obvious. Gas companies will have not only to go to additional expense in opening a road but to further additional expense in making good again. The steel reinforcement has to be cut away when opening a trench, and if the reinforcing properties are to remain effective the greatest care must be taken in reinstating the continuity of the new and the old work. The difficulty of this has been anticipated by the makers, and the system of repair is ingenious; but what was not anticipated was this trouble with the companies that have the legal right to open public roads. To place the whole additional burden upon their shoulders seems perhaps scarcely fair, and doubtless some middle course will be decided upon.

Water-Bound Macadam Road Test

Reference has been made in this paper to the Road Board Laboratory which has been established at the National Physical Laboratory for the purpose of testing road stones. Actual road sections are here subjected to artificial wear by means of the action of steel wheels variously loaded, while an attempt is made to impose certain weather conditions upon the surface. In the report of the Laboratory for the year 1913-14, the results of tests made during the year are given. One of these tests was that of a water-bound macadam road. The road (2 ft. 6 ins. wide) was built up as indicated in the sketch; 2 ft. of brick ballast was filled in on top of the gravel base and well rammed, the bottom of the ballast being drained with soil drains. Next followed 7½ ins. of furnace slag, watered, and well rammed in two layers, the interstices being filled in with hoggin. The test road proper, 4½ ins. thick, was made of granite (Penlee) stone shovelled in, well rammed and rolled. It was made in four sections:— (a) 2¼ ins. stone; (b) 2¼ to ¾ in. stone; (c 1½ ins. stone; (d crusher run. A test was then made on the central 24 ins. of the track by subjecting it to the action of the 8 steel wheels, each 3 ins. in width, the total load on each wheel being 800 lbs. Longitudinal and cross sections of the road were taken mechanically in order to obtain the amount of deformation of the surface and to study the production of hollows and ridges. After enduring 3,000 tons per yard width the surface of the track was so broken up that the test was discontinued.



Water-bound macadam test road.

Tar Macadam Road Test

In the case of the next test, the previous road was dug out, leaving 20½ ins. of brick ballast; upon this was laid 7 inches of binding gravel, which was well rammed. The remainder of the foundation was made to a specification prepared by Colonel Crompton, with 4 inches of blast furnace slag in two layers, each layer being rammed with pitch grout. A tarmac road was then laid on this foundation in two layers, one 2½ ins. thick and the other 1½ ins., each layer being well rolled, and tarred chips being sprinkled over to fill the interstices. The total weight on each wheel in the test was 1,400 lbs. and during the first 20 minutes considerable lowering of the level, amounting to about ¼ inch, took place and was probably due to consolidation of the material. As the test proceeded it was found that there was a tendency for the material of the track which was not subjected to the action of the wheels to be forced upwards by the action of the inner and outer wheels, which on this account sank lower than those at the centre. It appeared, therefore, that this test did not give an accurate measure of the endurance of the track, although valuable information on the formation of waves was obtained. After 36,750 tons per yard width the mean deformation was 0.64 ins., and the rate after 11,200 tons per yard width was about .0041 inches for 1,000 tons per yard width. The result of these tests must be received with caution and reserve. They may be regarded as what would happen to similar forms of construction under ordinary and practical conditions of wear and tear; but they may just as well be regarded merely as what does happen under the Road Board test, which is quite a different thing. Everyone knows that tar-macadam outwears water-bound macadam, and that is as far as one can with safety go at present. There were other tests made with roadways formed in accordance with the Road Board specification, but it is obvious that these lose their value as they were made by the Board itself. It is a case of special pleading.

Siege Gun Platforms

Quite a crop of siege gun platforms have been raised in London during the past few weeks. The most important "find" was at Acton where, it was alleged, a German firm had built a one-storey factory with a concrete roof having a thickness of no less than four feet. Later intelligence reduced this to three feet, and calculated inspection finally settled that it was under one foot thick and built in reinforced concrete. As the factory was in use as a printing works, where a large quantity of paper was stored, the thickness of the roof—which, it was allowed, was ultimately to serve as a floor (when further storeys had been added)—was not excessive. Had the journalists who reported this case had any technical knowledge, they would have recognized from the first that they were on a mare's nest. To commence with, a four-foot concrete roof on a one-storey building would have created a sensation when it was put up some years ago. Then, again, it is not customary to use a floor for the support of the upper storeys of a building. Walls are built on walls, and unless the walls of this building were buttressed and built in the most substantial manner, and well tied together (by something more than a concrete roof) the kick of the first shot fired from a German siege gun would have brought the whole building to the ground.

Professional Bids

The Eastern Valleys (Monmouthshire) Joint Sewerage Board invite applications for the position of engineer to the board, to advise them as to the preparation of a sewerage scheme and other works. Applications (runs the advertisement) are to state qualifications and terms required, which means, in plain language, that engineers are to tender for the work. Now this places the engineer in a very difficult position. Naturally, he wants the work. Things are very bad in Westminster through the war, and the shutters will have to be put up in more offices than one. But the rules of the Institution of Civil Engineers prohibit touting and advertising, and the man who tenders for this job runs the risk of reprimand, if not of compulsory resignation. Etiquette alone would perhaps prevent engineers from entering a competition of this kind, did not the necessity for earning a living intervene. The proper course in a case such as this (the writer has it on high authority) is for the local body to approach the president of the institution, asking him to appoint an engineer. Competition would then be avoided, and the circle of satellites which revolve around the presidential chair would again come into what is called "their own." The profession is however growing restive, and developments of a revolutionary nature may mark the next few years. To him who hath shall not be given for ever, and there will be keen competition over this Monmouthshire job.

According to reports received in Ottawa from Mr. F. A. C. Bikerdike, Canadian Trade Commissioner, Manchester, Eng., Canadian manufacturers have now the opportunity to supply Great Britain with the following products owing to the discontinuance of imports of iron and steel manufactured articles from Germany:—Wire nails, cut nails, nuts and bolts, machine screws, barbed wire, and domestic wire goods.

About 6[illegible] per cent of the permanent way of the Swiss Federal Railways are equipped with steel sleepers. The weight of the sleepers is 25.16 kilos. per running meter, and when the holes for the rail attachments are complete they weigh 72.5 kilos. (159.8 lbs.) each. The tensile stress specified is from 35 kilos. to 45 kilos. per square millimetre, and the entire trough piece must be capable of being bent back double without showing any crack. At the switches double-trough sleepers are used, which weigh 125 kilos. (275.5 lbs.) each.

County and Municipal Engineering

THE field of county and municipal engineering offers no inducements to the seeker of wealth. The engineer of brilliant intellect that seeks to conquer mountains and bridge untamed rivers and expects to reap rewards commensurate with his ability had best seek some other field for the utilization of his gifts. But to the man of sound judgment and moderate but well balanced attainments in the details of the work of a civil engineer the field of county and municipal engineering has always proved attractive and will become more so in the future.

The welfare of the modern city and the modern countryside is yearly becoming more dependent upon those structural works which it is the province of civil engineers to construct and maintain. Moreover the proper administration of civic affairs requires such a detailed knowledge of these mechanical features that a public official is no better fitted for their oversight than by the training received by a civil engineer. That the public is realizing this fact is well illustrated in the appointment of many civil engineers to positions as city managers, county road superintendents and city and county engineers.

The salaries attached to such positions have always been low and will probably always remain low. But the number of openings is steadily increasing and the certainty of continuous employment is perhaps on a firmer basis than in any other branch of civil engineering. A field for service as operating engineers for structural works is developing. Examples of the positions in this field are those of county engineers and road superintendents, waterworks superintendents and sewage plant superintendents.

Civil service and the commission form of government are factors that have contributed toward eliminating much of the uncertainty of employment that heretofore has been the chief objection to such work. And yet with its uncertainty the engineering work of cities and counties must be performed regardless of wars and financial conditions and the engineer well versed in the details of such work has no real excuse for being idle.

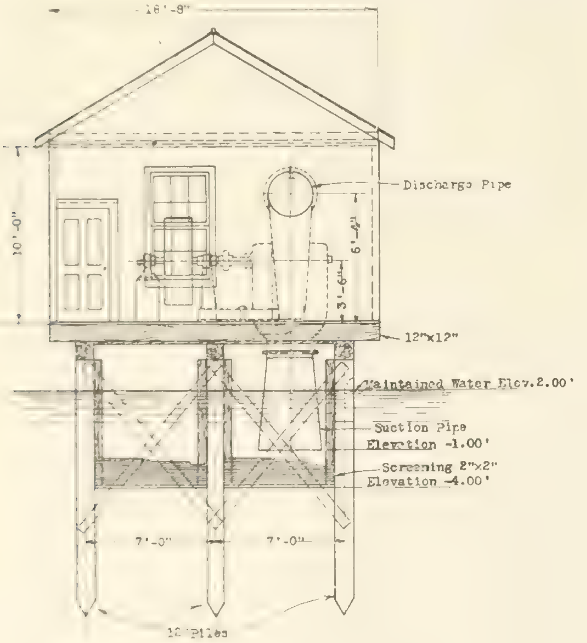
The field is, however, for the general practitioner rather than the specialist. More than mere technical proficiency is required. Tact, executive ability and a disposition to remain contented in one position are also necessary. The duties of men employed in this field while broad in their scope and demanding ingenuity and the ability to use funds—frequently insufficient funds—to the best advantage are comparatively simple and routine from an engineering standpoint. For this reason, perhaps, salaries are low.

For the engineer that takes pleasure in designing engineering structures and working out his designs on the ground in person, for the engineer that delights in the organization of construction work and the trying out of his individual ideas, for the engineer that is content to work for a moderate salary, county and municipal engineering offers attractions. But for the man that commercializes his ability and demands adequate financial return the field offers few inducements.
—Engineering and Contracting.

Pumping Plants on Dyked Lands in British Columbia

Contributed by W. Poole Dryer, Vancouver, B.C.

IN British Columbia, where rugged mountains monopolize so much of the area, the valleys and the flat lands are in great demand for the uses of agriculture. Along the estuary of that great waterway of the province, the Fraser River, there lie extensive deltas silted up for ages with deep alluvial soil. Although these flats are unusually fertile the cultivation of them is not possible without dyking, as every year they would be inundated by floods. Of this rich land 43,126 acres have been reclaimed; earth dykes have been built, large pumping plants installed; so that now there are living on it hundreds of prosperous settlers. In Vancouver, twenty to forty miles distant from all sections, a nearby market is provided.



Front end elevation of pump house at Maple Ridge.

Although the land is privately owned, its reclamation is financed and administered by the provincial government. To look after this work a Department of Dykes was formed and placed under the superintendency of Mr. E. A. Wilmot. The initial cost of reclamation was met by the sale of 40-year 5 per cent. bonds. All annual expenditure for pumps and administration is defrayed by an acreage tax. This tax is levied upon separate districts according to the expenditure actually incurred in each, for by its topography the land naturally divides into six districts ranging in area from 1,125 to 19,000 acres.

Round each district is a dyke, following along the riverside and running into the higher ground inland. The first dykes were built twenty years ago, and since then others have been added. Steam-driven pumping plants were erected, but in time these proved to give insufficient drainage and were very costly to operate. In 1912, however, the government, realizing the desirability of increasing the settlement, decided to do so by improving the drainage, that the soil by being kept drier would be made fully productive. This entailed the electrification of the old steam-driven plants, and the building of new electric pumping stations. The additional outlay of money involved had to be carefully considered so as to prevent imposing a heavy burden on the settlers; for it should be borne in mind that the ultimate financial success of reclamation and of irrigation schemes depends to a large extent upon low pumping charges. In the work outlined here great care was taken to select pumping machinery which could be operated at a minimum cost, and which had features specially fitted for the conditions. These features, which have proved in the last season's pumping to be conducive to economy, are described further on in detail.

Dykes and Ditches

Ramifying throughout the flats of each district are large drainage ditches, which feed into a main ditch running alongside one dyke—the dyke, in fact, is formed of the earth raised in excavating the ditch. On the Fraser River this ditch is located between the dyke and the river, for with the ditch on the inner side of the dyke (as in the earlier Pitt River reclamations), the seepage through the dyke into the ditch is very considerable.

Here and there along the dykes a cut is made in which is placed a large flap gate. Through these gates the main ditch empties into the river. Thus the land is drained eight months in the year, the river level being lower during that period. But with the melting of the snows on the mountains in the interior the swollen rivers rise from ten to fifteen feet. This rise, beginning in May, is maintained throughout the four summer months. The problem to be dealt with then is the drainage of the land lying at a lower level than the river—the flap gates have shut back and drainage by gravity has become impossible.

The pumping plants have then to be started running, and by their operation night and day all summer the districts enclosed by the dykes are drained. The water is drawn by the pump from the main ditch and is conveyed into the river by means of a discharge pipe passing through the dyke.

Some idea of the large volume of water to be pumped off the Maple Ridge district may be formed by considering that, on its area of 8,400 acres, the monthly rainfall of 5.6 inches—as in June, 1913—is equivalent to 42,000,000 gallons per day. In addition to this precipitation there is the water coming from the higher lands behind the dyked area, and there is also considerable seepage through the dyke from the river into the ditch; these two additions, however, are offset more or less by the general evaporation from the land.

In pumping such a large volume it will readily be seen that a burdensome expenditure will be incurred unless cheap power is available, and unless care is taken to select economical pumping apparatus.

Electrical vs. Steam Pumping

For twenty years pumping was done by steam power but the high cost of coal prevented as much pumping being carried on as was required to keep the land in the best condition. Electrification was not feasible until two years ago when the transmission lines of the Western Canada Power Company, leading to Vancouver, were constructed near the dyked lands.

With the advent of this cheap hydro-electric energy a new epoch opened up in the cultivation of these reclaimed lands. The dyking authorities immediately grasped the opportunity of utilizing this source of power greatly to improve the fertility of the soil. At the old expenditure incurred by steam power, double the pumping could now be done, the water in the ditches lowered by two feet, and the sogginess—with the resulting sourness—eliminated from the soil. The four old steam pumps were therefore electrified, and five new electrical pumping plants built. On these lands administered by the government there are installed 1,050 h.p. of motors on pumping duty. The economy resulting from the abandonment of the use of coal has proved most gratifying. The relative cost of operation may be compared in the Matsqui Stations, where two 200-h.p. motors now operate the old steam-driven pumps. The following table gives the cost actually incurred in the same stations, with approximately the same pumping results:

	1911 steam operation	1912 electrical operation
Cost of wages	$2,149	$ 807
Cost of coal	2,545	......
Cost of electric power.	......	1,039
Cost of supplies and maintenance....	211	144
Total cost of operation	$4.905	$1,990
Number of hours pumping.	1,413	1,107
Cost of pumping per hour	$3.47	$1.80

These figures, moveover, do not put the best complexion on the results of the electrification, for the interest on capital cost is now much lower than with the steam-driven plants; with the latter there is the engine and the boiler, as compared with only the motor in the new installations.

The success of this electrification is in no small measure the result of the effective manner in which the Power Company co-operated with the dyking authorities. It entered into a contract to supply the provincial government with cheap energy for all the reclamation stations, lending its engineers for supervising the alterations and for advising in the selection of the new machinery. Acting for the Western Canada Power Company, Mr. J. F. Cahan, their construction engineer, designed and personally superintended the building of these plants.

As an important element governing the design of the pumping stations, it should be mentioned that these have all been arranged so that the unskilled sons of the ranchers can safely operate them. This condition dictated the choice of apparatus which would be reliable and be automatically safeguarded to the highest degree.

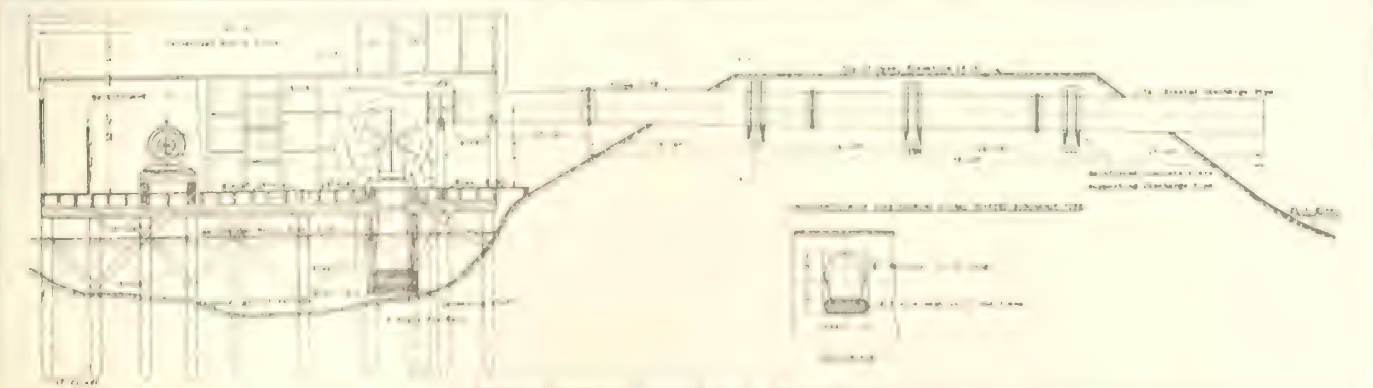
Pumps—Construction

The commercial success of reclamation and irrigation schemes like this depends to a large extent on economical pumping, and this, in turn, is determined by the selection of suitable machinery. The pumps must be carefully designed so as to be highly efficient. As excellent results have been obtained by the large pumps installed on the dykes this year, it will be of interest to call attention to the outstanding features of their construction and performance.

These pumps were obtained from The W. Poole Dryer Company, Limited, Engineers, of Vancouver and Glasgow, who had been engaged on the electrification of all the old steam stations, and were familiar with the pumping conditions. This firm had the pumps manufactured to the most modern designs by Messrs. Gwynnes, Limited, of London, England. Each of the pumps has a capacity of 30,000 U. S. gallons per minute, the head varying from 6 to 12 feet. Both the discharge and the suction openings are of 30-in. diameter. The drive is by means of a 16-in. belt from an electric motor. Although a certain loss necessarily results from the belting, still, with this arrangement, the overall economy is greater in this instance than would be with a direct drive, which for low heads demands a compromise between the best inherent speeds of the pump and the motor. In other words, a pump for a low head should for best efficiency run at a speed which is so slow that a motor designed for it would be very large and expensive.

Maple Ridge pumping station 100 h.p. motor—3 phase, 2,300 volts. 30,000-gal. Gwynne pump.

It will be seen from the illustration that the pump


Sectional elevation, pump house at Maple Ridge

casing is constructed so as to allow suction pipe arrangements of the simplest nature. One single large pipe suffices, and it is located directly under the centre of the pump, the compactness showing itself both above the floor and in the small size required for the intake well. Inside the pump casing the suction passage divides, so as to give a balanced flow on to both sides of the impeller.

A handy feature of the construction is that the casing is arranged so that the impeller can be withdrawn sidewise without disturbing any of the piping. This accessibility of the interior is carried still further by locating on the casing two handholes, so that an inspection on the inside of the pump can readily be made without having to disturb any connections.

In laying out such a pumping plant the proper design of the suction pipe is of vital importance. Care was taken in the present installations to make this part short and straight; and its diameter is large, tapering as it does from 30 ins. at the top to 48 ins. at the bottom. The effect of the large area at the lower end is to allow the water to enter the pipe with a low velocity, and to this point attention has to be paid, for in some of the older installations it was found that the high entrance velocity imposed by a small suction pipe resulted in a whirling motion in the inrushing water in the ditch; the funnels of air which were thereby formed leading to the destruction of the vacuum in the pump casing.

When arranging installation of this kind there arises always the double question of how the pump is to be primed, and as to whether or not a foot valve should be placed on the suction pipe. The method which the dyke engineers have standardized on was adopted in these two new plants; the foot valve is omitted and the priming is accomplished by means of a small air compressor with its connections reversed so as to act as a vacuum pump. By this arrangement the large casing of the centrifugal pump is sucked full of water in a few minutes. The vacuum pump is belt-driven by a 2 h.p. 220-volt, 3-phase motor, the low voltage being obtained from the two lighting transformers.

Pumps—Performance

Great care must be exercised in selecting the pump to see that it has the performance characteristics suitable for reclamation work—that is, that the power required is as nearly constant as possible for all likely heads. For it has to be kept in mind that in such schemes as this the head is likely to vary by 100 per cent., due to the uncertain level of the river in different seasons. This condition demands a pump of special design; in an ordinary centrifugal the power consumption increases so considerably with altered lifts that there would be serious danger of burning up the motor when the head varied from a given normal. This trouble was obviated in the pumps here illustrated by having the pump volute so designed, that the h.p. consumed remained constant throughout the whole range of head, the output adjusting itself to suit. This novel characterisic has allowed the use of a small-sized motor which can be worked to full capacity under all conditions, and yet not be in any danger of overloading. Actually the motor is of only 100 h.p. rating, despite the fact that the pump is capable of delivering the large volume of 30,000 gallons per minute, and although the head is so inconstant that at certain periods it is double that at others. The advantage of having a pump designed so as to automatically safeguard the machinery against overloads is obvious.

To supply these pumping plants with energy the Power Company ran along the dykes pole lines carrying 3-phase circuits of 2,300 volts, which is supplied direct to the motors without transformation. All wiring and switching arrangements inside the station are made simple and safe, so that skilled electricians are not required for operating the machinery. The motor used has a wound rotor, as this type gives the good starting torque required—for the pump, being primed at rest, is half-loaded to begin with, even although the closed gate valve prevents pumping. On gaining speed the rotor resistance is cut out step by step by a hand-operated switch, and on attaining full speed with the slip rings short-circuited the full load is applied by opening the gate valve and so allowing pumping to commence. The switchboard carries an oil switch connecting the incoming lines to the stator. To safeguard the motor against excess current a time limit over-load trip is attached to the oil switch, and furthermore, 2,300-volt cartridge fuses in the primary circuit are aided on the board. So that the building can be completely isolated. An oil switch operated by a rope line is located on the pole outside.

Pump House

As several different styles of pumping houses have been erected on the dyked lands, it will be of interest to describe the type of construction that the dyking authorities have now found by experience to be the most serviceable. What was wanted was a strong, durable, and above all, an inexpensive building that would properly house good pumping machinery. One of the accompanying illustrations shows one of these new pump houses; and it has to be remembered that the small ranchers whose taxes pay for these plants want merely a strong and neat building so designed that the pumps can be run as economically as possible. At such a pioneer stage economy, and not ornamentation, is the ruling factor. To fulfil these conditions it was found that the best arrangement was to build the pump house on piles driven into the ditch. While being amply strong, this construction has proved to be better than erecting on the adjacent land, where not only are concrete foundations necessary, but where considerable excavations have also to be made for the intake well.

The building is made of thick corrugated galvanized iron sheets covering a skeleton wooden framing, which is closely spaced and cross-braced. The overall dimensions are 40 ft x 19 ft. x 10 ft. The floor is placed as low down as possible, in fact only a few inches above the high-water level of the ditch; this allows the centrifugal to be placed where the pump should always be placed—down near its work, with as short a suction pipe as possible. The whole structure sits on 12 in. x 12 in. beams, which cap the twenty-four 12-in. piles. Attention may be called to the fact that these piles are rigidly braced together by diagonal ties, so as to prevent the structure receiving any vibration from the rapidly rotating machinery. The use of cedar piles has assured long life to these foundations.

This simple construction of the pump-house has much to commend it over other more elaborate designs. It is serviceable, yet very cheap. It has an immunity from fire risk not possessed by a plant constructed on solid ground; owing to its isolated location out in the ditch, it is away from the prevalent bush fires. That this fire hazard is still further lessened by the sheet iron construction of the walls was demonstrated lately, when the wooden steam pumping station at Upper Coquitlam caught fire from the bush and was consumed, whereas the new sheet iron electric plant just alongside was saved.

The resultant effect of these pumping schemes has been greatly to enhance the value of the 40 000 acres of dyked land, so that much of it has fetched in sale $500 per acre; while by the combination of cheap power with carefully chosen pumping machinery the annual dyking tax has been kept down to an average of $1.60 per acre; and in time this tax will diminish, as it is paying off not only the cost of the new electric plant, but also of the very expensive original steam stations.

C.N.R. Bridge Work at Calgary

(Staff Article)

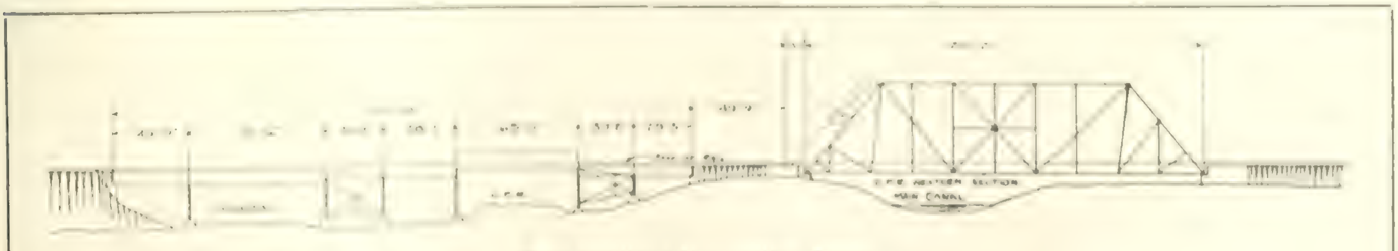
THE Calgary-Vegreville Branch of the Canadian Northern Railway enters Calgary from the East, the route in the city requiring eight bridges, having a total of some twenty spans The many varying conditions to be met and the requirements to be fulfilled make these structures of interest. There are three railway crossings, two highway crossings, one street crossing, two river crossings, an irrigation ditch crossing, and an overhead highway bridge. These include a structure over 600 feet in length, carrying the tracks over the Calgary Canal of the Canadian Pacific Irrigation Department, over the three tracks of the same company, and over the street railway and road allowance between the city and the Ogden Car Shops of the Canadian Pacific Railway; a six-span plate girder bridge across the Bow River; and a three-span combined highway and railway bridge over the Elbow River, in the heart of the city.

Of the entire group of bridges, two are of particular interest—the one for the number of conditions to be complied with, the other for the unusual simplicity of conditions. The tracks across the Irrigation Canal at the vertex of a sharp curve, necessitating a long span truss bridge, with a sharp skew. Immediately west, parallel to the canal bank at this point, are the three tracks of the main line of the Canadian Pacific Railway to their shops, and a few feet further west is a public highway upon which runs the track of the Calgary Municipal Railway. Three requirements as to clearances had to be met at these crossings, and the resultant structure has an aggregate length of almost 580 feet, broken only by the short width of the canal bank. A half-mile further within the city limits the line crosses the Bow River, six-plate girder spans of equal length being built, with a length of 540 feet.

The first-mentioned structure is a through rivetted truss bridge, 211 ft. long, 48 ft. high, with a skew angle of about 34 degrees. There is a short break of about 50 feet across the bank, when the tracks are carried on a plate girder viaduct having seven spans with an aggregate length of 305 ft. 8 ins. The truss has a modified Pratt truss latticing, with counter and horizontal pin connected bracing in the centre panel; the skew angle introducing an unequal panel length. At the east end of the north truss, and the west end of the south truss, there is a panel 25 ft. 2⅝ ins. long, with a panel half that length at the opposite end, and eight intermediate panels 21 ft. 8 ins. long. The trusses are placed 18 ft. 4 ins. on centres, and have a depth of 48 ft., centre to centre of chords, and a length of 211 ft. 2 ins. between bearings. The main bottom chords consist of four 8-in. by 6-in. angles, and two plates 17-in. by ½-in., latticed; the main top chord consists of one cover plate 24-in. by ½-in., two web plates 20-in. by 9-16-in., two angles 4-in. by 4-in., and two angles 6-in. by 4-in.; both members having lengths of practically 50 feet. The top lateral bracing follows much the panel arrangement of the main truss and consists of latticed angle struts. The bottom laterals and floor system are arranged in ten regular panels of 21 ft. 8 ins., having a total length of 216 ft. 8 ins. There are two rows of stringers, 8 ft. centre to centre, composed of four angles, with 44-in. web plates. The floor beams, at the panel points, are built up of four angles 6-in. by 6-in. by ⅝-in., and have a web plate 56-in. by ⅜-n., base of rail being 4 ft. 5 ins. above the centre line of the main bottom chords.

211-ft. rivetted truss C.N.R. crossing over C.P.R. Calgary canal.

The second structure has seven spans, only two of which are equal, carried on steel columns and concrete pedestals, with a total length face to face of abutments of 308 ft. 4 ins. At the east end, next the Irrigation Canal, there are two deck plate girders, followed by a through span across the C. P. R. tracks,



North elevation C.N.R. crossing, Calgary then two short spans followed by a deck plate girder span with drop ends, over the highway, and another span west of that. The span crossing the railway tracks has a length of 65 ft., and is raised to a through span in order to gain the required clearance above the C. P. R. of 22 ft. 6 ins. The girders are 17 ft. 6 ins. on centres, and have 96 -in. by ⅜-in. web plates, with flanges composed of two 6-in. by 6-in. angles and two 14-in. cover plates. All the other girders are 8 ft. centre to centre. The span over the street rai!way and highway has a length of 72 ft. 6 ins., and the web paltes are 100 inches deep at the centre, being cut to 66 inches in depth in a distance of 12 feet from each support. The flanges are composed of six angles and a single cover plate. The through span is carried on 18-in. rolled H-section posts, all the other posts being 14-in. rolled sections. The intermediate spans all have a uniform depth of 5 ft. 6 ins., the two equal spans having longitudinal bracing. There are about 700 tons of steel in the viaduct alone.

The Bow River Crossing is a simple structure of six 90-ft. deck plate girder spans, supported by five concrete piers in the river bed, with reinforced concrete abutments of the wing type. The crossing has a total length of 50 ft. between the abutments, the base of rail being 41 feet above extreme high water level. The girders have an extreme length of 89 ft. 8 ins., are 9ft. 7 ins. deep, and are 8 ft. on centres, weighing about 23 tons each. The top flange section is composed of four angles, the bottom flange of two angles and two cover plates. The bearings are fixed at one end, with expansion bearings at the opposite end.

Portals, 211-ft. rivetted truss, C.N.R. crossing over C.P.R. Calgary canal.

The erection of these structures was done during last fall and winter, the contractors using a 35-ton 3-drum Lidgerwood derrick car, with a timber boom 56 feet long. The erection of the viaduct was accomplished in eight working days. The Bow River crossing was erected at the rate of three complete spans a week. During the erection of the latter structure, the timber boom broke close to the seat, allowing one end of the plate girder in the leads to drop to the rived below, the other end resting on the abutment. No particular damage was done, however, and erection was completed with a similar boom. The truss span was erected on trestle falsework by the same derrick car. The contractors for the erection of all these spans were Messrs. Frankman Brothers, of Winnipeg. All of the concrete work for these bridges was placed by F. Ferhenbach & Company, Limited, of Calgary. With the exception of the Bow River crossing, which was fabricated by the Canadian Bridge Company, Limited, of Walkerville, Ont., all the structures were fabricated by the Manitoba Bridge & Iron Works, Limited, of Winnipeg.

Safe Loads on Footings

A good method of deciding the safe load on footings is given in the following formulae:—

Divide the total load in pounds by the safe load in pounds per square foot; the quotient is the required area in square feet. The following values for the bearing power of soils given by Prof. Ira O. Baker, have been generally accepted.

Nature of Soil	Bearing power in tons per sq. foot. Min.	Max.
Rock—the hardest in thick layers, (in native bed)	200	..
Rock—equal to best ashlar masonry	25	30
Rock—equal to best brick masonry	15	20
Rock—equal to poor brick masonry	5	10
Clay—on thick beds, always dry	4	6
Clay—on thick beds, moderately dry	2	4
Clay—soft	1	2
Gravel—and coarse sand, well cemented	8	10
Sand—compact and well cemented	4	6
Sand—clean dry	2	4
Quicksand—alluvial soils, etc.	0.5	1

A reinforced concrete pontoon, for a landing stage for ferry service, has recently been put into use in the harbour of Sydney, Australia. The pontoon is 100 ft. long, 43 ft. wide at one end and 68 ft. at the other, 7 ft. 9 in. deep, with a 32-in. freeboard. The bottom is flat, and the sides and ends are sloped to an angle of 70 deg. Special attention was given to the design of the reinforcement, with a view to enable the construction to withstand the excessive forces likely to occur at the same moment. In the construction of the top and bottom of the pontoon, allowance has been made for a live load of 150 tons, distributed over the centre length between the posts. The whole structure is divided into forty-eight water-tight compartments by solid reinforced concrete walls. It weighs about 650 tons.

A deep-water diving suit has been tested in Long Island Sound, off Stamford, Conn., in a depth of 212 ft., which is probably a record for deep-sea diving. The suit is in effect a metal casing, looking curiously like a suit of Chinese armour, and jointed at the elbow knee, hip and shoulder, to allow movement of the diver. One arm is provided with a searchlight and the other with a grappling hook. The casing completely envelops the diver, and is of sufficient strength to resist pressures at least as great as that experienced in the test. According to the owner's report, "no attempt is made to make the suit air-tight, so that all of the water that works in through the joints is kept out by an automatic pump." Air for the diver is supplied through a pipe to the helmet, which pipe also contains a telephone wire.

A start has been made on the footings of the new Registry Office which is to be erected in Toronto at a cost of $400,000. The building is to contain two storeys and basement and will be of stone and brick construction. The architect is Mr. C. S. Cobb, and the masonry contractors are Messrs. J. A. Wickett, Limited.

A Discussion of the Relative Values of Paving Material

IN a paper presented before the Cleveland Engineering Society by Mr. Geo. W. Tilson, a statement of the general laws governing the selection of the type of paving material best suited to the needs of traffic was made. The observations adduced by Mr. Tilson afford in part at least a solution of one of the important problems of the city engineer and as such cannot fail to be received with interest. We reproduce the paper in part as abstracted by Engineering and Contracting.

Stone Block Pavements

Granite and the harder sandstones are principally used in the stone block pavements of this country. The particular kind to be used will depend upon the availability and cost. It would be foolish to consider granite as a material where it must be obtained at great expense and where a good sandstone is available. In this study, however, granite is considered, as it is a material that is used in New York City and one with which the author is most acquainted.

In this connection it should be stated that the figures arrived at in this study by the author must be varied in every locality and must vary to a great extent according to the judgment of each individual engineer. He wishes it understood, however, that he does not consider the exact figures as of so much importance as the method of obtaining the results. So that too much importance should not be given to the results shown.

The granite pavements of today are very much better than those that were laid even four or five years ago. It has been found that on account of their being laid on a concrete foundation it has been possible to reduce the depth of the blocks and make them of somewhat smaller size otherwise, thus rendering it possible to get a better cut block at the same expense as before and allowing the blocks to be laid with a closer joint, thus reducing abnormal wear.

The blocks are laid on a sand cushion on a concrete base, the joints being filled with cement grout, tar and gravel, tar pitch alone, and sometimes a combination of pitch and sand. The author believes that with a small joint and a combination of good pitch and sand the best results will be produced. While a cement grout joint makes a smooth pavement, it is often difficult to close the street long enough to allow the cement to set, and it also makes a pavement that is exceedingly difficult to repair after it has been torn up for any substructure purposes.

In considering the value of different materials as applied to different streets it is assumed that an intelligent selection of the different materials has been made, as upon that will depend the results entirely. For instance, a granite pavement could be laid on a residence street with light traffic, where its durability would be long and the cost of maintenance practically nothing. On the other hand, an asphalt pavement could be laid upon a heavy business street, where its life would be short and the cost of maintenance enormous. If, however, an intelligent selection of material is made for all streets of the city, what will be the natural life and cost of maintenance will be found.

In 1913 in the Borough of Brooklyn the granite pavements cost 3.9 cents and the Medina sandstones 6 mills per square yard, all on concrete.

Wood Block Pavements

Wood pavements have been laid at intervals in this country for some seventy years. The first pavements were not only of untreated wood, but of wood selected without much regard for its natural durability. The result was failure, as could have been expected. The repeated failures of the different kinds of wood, however, although they delayed, did not prevent entirely the establishment of wood in this country as a standard material. The success of the wood pavements in Europe made it positive that they could be laid successfully in this country under proper conditions.

The first treated wood pavement in this country was laid on Tremont Street, Boston, in 1900. This pavement has been in use during this entire period with very small repairs, and is in good condition at the present time. It is composed of blocks treated with a composition made up of one-half creosote oil and the other half resin. Pavements of this character were laid in New York and other cities, but on account of the increased price of resin it was dropped out of the mixture and creosote oil only used.

There has been a great deal of controversy as to the character of the creosote oil to be used for this purpose, the principal point being the specific gravity. The theory of mixing the resin with creosote was that, it being a more stable material, it would prevent the volatilization of the creosote and so preserve the blocks from decay for a greater length of time. The object of treating the wood is to prevent decay and also to make the blocks stable by preventing the absorption of water so that they will not shrink in dry weather or swell in wet and thus cause bulging. It was thought that by using a heavier oil this result could be obtained as well as by the use of a light oil with resin. The relative values of the heavy and light oils have never been determined, but the author has always been in favor of the heavier oil.

The present method of laying wood pavements in this country has not been in use long enough to determine what the cost of maintenance is, but figures obtained from St. Louis, Minneapolis and other cities indicate that it is exceedingly small. Ths first pavement of this character to be laid in Brooklyn was in 1902, and it has had practically no repairs for wear and tear since laid. It is, however, on a light traffic street. The total cost of maintenance of the wood pavements in Brooklyn in 1913 was 1.4 cents per square yard on pavements that had been in use from 8 to 11 years. This cost, however, included, besides actual wear and tear, damage caused by openings in the pavement, although not the cost of repaving the openings themselves. In Paris in 1911 the cost of repairs was *26* cents per square yard. In London the average cost is *20* cents per square yard.

The fillings for joints in wood pavements are sand, asphalt or coal tar pitch, and cement grout. The practice in Brooklyn has been to fill the joints with sand, and first class results have been obtained. Some people, however, prefer the bituminous and others the cement filler; either will give good results when properly used, although the author does not look with much favor on the cement grout filler.

There is no question that wood block is an important paving material, and on streets where the traffic is heavy and noise is a great detriment it is most advisable. Its strongest point is its noiselessness and its weakest its slipperiness. It has been given a value as shown in the table.

Brick Pavements

The author has considerable hesitation in saying anything about brick pavements in such a community as this, where these pavements have been used so long and to so great advantage, and where the engineers know so much more about the subject than does the author. While he has not had so much experience, especially in recent years, with this class of material, he has kept in touch with the subject and recognizes fully the value of this material and the importance it has in the paving industry.

The use of burnt clay for pavements seems to illustrate as well as anything else how quick the genius of the individual is to take advantage of every gift of nature. In this central portion of our country, where there is no natural paving stone, there has been provided a quality of clay which when properly treated produces a material that is almost as good as that provided by nature herself, if not better.

The first brick pavements in this country were laid in Wheeling, W. Va., in 1870, but the material did not come into general use for some time. The author is free to confess that when his attention was first called to brick as a paving material he was not favorably disposed, but the success of the material after it was put into use was such that he was obliged to confess the error of his previous judgment. Many failures have occurred in brick pavements because people did not understand the difference between bricks, and it was not easy in the early days of the industry to determine previous to its use whether a certain brick would or would not make a good pavement, and then it was not known what was the best method of laying. Both of these matters, however, have been fully threshed out, and, in the judgment of the author, this is mainly due to the work of the National Paving Brick Manufacturers' Association, which has maintained a paid secretary to look after the interests of the brick manufacturers, not simply to enable the manufacturers to sell their product, but that every city should get the best possible brick pavement obtainable.

With the present knowledge of the art of making brick and the methods of testing and laying, it is as possible to determine in advance what the results will be with brick as with any natural material.

It is conceded, of course, that brick pavements, like all others, must have a good foundation so that the question at issue, after the bricks themselves have been determined upon, is principally the cushion on the concrete and the character of the joint filling. The National Paving Brick Manufacturers' Association has always been very strong in advocating a 2-in. sand cushion laid upon the concrete. Most engineers in the East, however, believe that only 1-in. is necessary and that no more should be used, the idea being that all that is required is to have a sufficient quantity to allow the brick to be well bedded and have an even bearing over its whole surface. If, however, experience demonstrates that a 2-in. cushion is better than a 1-in., the extra expense is negligible and it should be adopted.

Three kinds of joint filling have been used: sand, coal tar pitch, and cement grout. At the present time sand is not used to any great extent, as it is conceded that a material should be used that will protect as much as possible the corners of the bricks so that the wear may be in accordance with the principle previously laid down in this paper—as nearly vertical as possible.

The question of coal tar pitch and cement grout cannot be so easily dismissed, however. The advocates of both materials are very many and present strong arguments, and it must be admitted that good results have been obtained with both kinds of filling. The author believes, however, that if proper care be taken in the laying and in the application of the filler, cement grout will give the best results, as it will come more nearly to making the pavement a monolith. Some trouble has occurred in the past with this filler on account of the rumbling of the pavement under traffic. This trouble, however, has been nearly, if not entirely, obviated. There is the objection to a cement filler, however, that it is more difficult to open a pavement and replace it in case it becomes necessary on account of the subsurface work.

It is almost impossible to set any figure for the life of a brick pavement or the cost of repairs, as these depend almost entirely upon traffic. The figures given in the table have been made out principally from data received from large cities, and undoubtedly they would be modified if obtained from the state of Ohio, for instance. But as has previously been said, all figures of the table must be adapted to local conditions. The results determined upon are shown in the table.

Asphalt Pavements

Under the head of asphalt will be considered sheet asphalt, asphalt blocks and bitulithic, although the latter is perhaps more often used with coal tar pitch than with asphalt.

Sheet Asphalt.—The first pavement of any note of this character was laid on Pennsylvania Avenue, Washington, D. C., in 1876. So great was its success that it soon came into general use all over the country. While called asphalt pavement, it is almost entirely composed of sand, as the standard pavements have but 10 to 12 per cent. of bitumen, which is the valuable property of the asphalt, the rest being made up of sand and a small portion of stone dust. The pavement is pleasing in appearance, smooth, not noisy, and on light traffic streets seems to be almost ideal. It is more slippery than the hard block pavements, and in the coast cities it is not generally laid on grades over 3 or 4 per cent. In the interior, however, where the atmosphere contains less moisture, it is often used on grades as high as 7 per cent. without trouble.

Data collected from the cities of Brooklyn, Boston, Buffalo, Chicago, New York, Philadelphia, St. Louis and Washington shows that these cities in 1890 had a total of 246 miles of asphalt pavement, and in 1911 2,348 miles. This gives an idea of the popularity of the pavement, although it must be taken into consideration that this was during a period when there was great activity in laying new and smooth pavements. In Brooklyn, for instance, in 1895, there were 18 miles of asphalt pavement, while at the present time there are 540 miles. Brooklyn is a residential city, without many steep grades, and one to which this material is particularly adapted.

The cost of repairs to the asphalt pavements in the Borough of Brooklyn in 1913 was 3½ cents per square yard, and in the Borough of Manhattan for 1912 it was 14.1 cents per square yard, this being due to a great extent to the difference in traffic in the two cities. In the city of Paris in 1911 the cost was 19½ cents per square yard.

In London the contract price on Cheapside per yard per year was 56 cents for 15 years beginning after the pavement had been down two years. The average cost of repairs in London is 30 cents per yard.

Asphalt Block.—This is another form of asphalt pavement and consists of blocks, made under heavy pressure at a central plant, composed of asphalt and broken stone aggregate rather than sand, as is used in the sheet pavement. The mixture of the material can be absolutely regulated and the pressure made uniform, so that the blocks produced should be uniform in density and quality. On account of the stone aggregate being coarser (say from ¼ in. downward) than the sand, the surface of the pavement affords a better foothold than the sheet asphalt, and also on account of the joints between the blocks. So that where a smooth pavement on grades is desired asphalt blocks are particularly desirable. They are used, of course, to a great extent on streets of light grades.

An objection to them is that as they have to be manufactured at one location the entire surface of the pavement must be transported from the plant to the street, while with sheet asphalt the plant can be located at a convenient point so that the haul is not so large. This makes a difference in the expense against the asphalt blocks. On the other hand, however, an asphalt block pavement can be repaired without the use of a mixing plant, as the blocks can be purchased and brought upon the street and used when desired.

Asphalt block pavements in the Borough of Manhattan in 1912 cost 9.8 cents per square yard for repairs, and in the Borough of Brooklyn for 1913 1.2 cents per square yard.

Bitulithic Pavements.—This pavement was first laid about ten years ago. A gentleman who had formerly been interested in asphalt pavements conceived the idea of improving the then existing methods of laying a macadam pavement by filling a portion of the voids with a bituminous product or bitumen mixed with some other material. By the gradual elaboration of his original idea there was evolved a pavement which is now known as "bitulithic." It is essentially a macadam pavement of selected and graded stone, so that the voids in the stone shall be as small as possible, the binder being a bitumen, either coal tar or asphalt, both having been used. The pavement, being formed of coarse materials, can be laid on quite steep grades with satisfactory results. The writer has had no personal experience with this material, but has observed its construction and use in other cities. It has been laid very extensively in this country and would undoubtedly have been used to a greater extent if it were not patented. It is considered as standard and ranks with asphalt pavements.

Traffic

Knowing, however, the kind of material and the properties thereof are not sufficient for the official whose duty it is to determine the particular one to be used, he should also know the requirements of the streets to be paved. In order to do this he should have records of the kind and character of the traffic upon each street, or upon typical streets. Of course it is not necessary to get a total census of traffic on all residential streets, but of these a note by an inspection it can be told to what class they belong.

And in speaking of traffic it should be understood that as at present considered the words "heavy," "medium," and "light" traffic mean very little, except with reference to any one particular city. There should be a standard unit of traffic, so that when the traffic on a certain street is given it could be distinctly comparable with traffic in another city. To do this it is necessary that the effect of traffic upon the different materials be known. Little attempt has been made to determine this, but within the last two or three years the English Road Board has constructed a machine for making this determination, and a somewhat similar machine was exhibited at the American Highways Association meeting in Detroit last fall.

It can be easily understood that a vehicle weighing with its load 15 tons will have an entirely different effect upon a pavement than 15 vehicles each weighing 1 ton. It makes a difference, too, whether the tires are steel or rubber, whether they are 1 in. or 3 ins. in width, and whether the vehicle is moving at a rate of 6 or 30 miles an hour. Experiments can be made so that the wear of the different vehicles under different loads can be ascertained and referred to one unit, and until this is done the adjectives "heavy," "medium," and "light" must be considered very indefinite.

I think on the streets that will be subjected to the heavy traffic, it will undoubtedly be necessary in the future, if motor trucks are to be continued with heavy loads as they undoubtedly will, to lay heavier foundations on streets that will be subjected to that traffic. It may be necessary in the large cities to have certain streets assigned for those heavy trucks. I do not think it is fair to a city or the property owners to be compelled to lay pavements with a strength sufficient to hold up those heavy loads, although I was quite surprised in Glasgow in speaking to the engineer about their extreme loads when he said that even under the heaviest conditions they did not use more than six inches of concrete, but in London, on the heavy traffic streets they are using eight inches. If we are going to have these enormous loads, as we undoubtedly are, some special provisions must be made for them.

In connection with these loads, the city consulting engineer of New York had in mind for some time the regulating of these loads by ordinance, and having the people who use those excessive loads pay a license fee for their use. In making investigations, it was found that the large trucks with the wide tires sometimes had a load of 1,500 to 1,800 pounds per inch of tire on the streets, and it was the intention not only to regulate the total load, or load per wheel, but the load per inch of tire. An ordinance was drawn up to accomplish this, but it was finally decided that such an ordinance would be in the nature of a tax, and that these trucks were taxed once by the city, and that they could not be taxed again.

The borough engineer of Fulham, London, has established what he thinks is the wear that will take place on wood pavements under a certain traffic, and, having observed the traffic on any particular street, he figures out how long a wood pavement should last. This, however, is indefinite for the reasons before given.

And even after the value of the traffic unit has been established it will be difficult to apply it positively, as in every case the weight of the vehicles upon it must be estimated.

Then after all that has been determined there are certain local conditions which must also be taken into consideration. For instance, if the traffic requirements are such that a brick or stone pavement should be used for economic reasons, it is possible that longer tals, school houses or churches may be situated on certain portions of the streets, so that it would be necessary to lay wood on account of its noiseless property. Then, too, the official will learn that the wishes of the users of the street and those doing business on it must also be taken into consideration, and he often finds that the two will conflict, as the truckman cares nothing about the noise and the business man cares little for tractive or non-slipper properties. So that, despite all information that can be obtained, in order to arrive at a satisfactory result the different conclusions must be treated together and intelligently. If, however, all these matters are taken into consideration, it is seldom that an improper determination will be made.

Funds for Maintenance and Repair

It might be in order to discuss to a certain extent the economics of the different kinds of pavement. When an original pavement is paid for by assessment upon the abutting property, with repairs and repaving done by the city at large, it often becomes necessary to establish legally just when a street should be repaved. This is more easily determined by inspection in a block pavement than in a sheet pavement, as it can easily be seen when the blocks are worn out, but with a sheet pavement patching can be carried on for a long time and to a great extent without there being any formal repaving. Take, for instance, the case of an asphalt pavement, and assume for the sake of the illustration that the original pavement is paid for by a bond issue continued during the life of the pavement, which in this case is assumed at 18 years. The items of cost in the maintenance of this pavement on a street are: (1) First cost; (2) Interest on the bonds; (3) Annual repairs; (4) A sinking fund to be collected each year to pay for the bonds when they mature.

Assume that an asphalt pavement will cost $2 a square yard, that the interest on the bonds is 4 per cent., and that it will cost on an average 4 cents per square yard per year for repairs. This can be shown in a formula, such as:

$$A + CI + \frac{R}{N} = \text{annual expense,}$$

—when A equals sinking fund charges, C equals first cost, I equals rate of interest, R the estimated cost of total repairs during the life of the pavement, and N the life of the proposed pavement.

Substituting these values in equation we have:

$$.078 + 2.08 + \frac{72}{18} = .198 \text{ for the first period;}$$

—that is, the cost to be raised by the city every year to maintain this pavement would be 19.8 cents per square yard. When, therefore, the annual repairs on a street approximate this amount the question of repaving should be carefully considered. If, however, the same pavement is continued upon the street, succeeding pavements would cost less, as the foundation must have a material value.

The following table shows the cost of different kinds of pavement for a period of years, assuming that granite has a life of 25 years, wood 20 years, brick 15 years, and asphalt and bitulithic 18 years. This life, as has been intimated before, is probably too small for Ohio brick pavements or those in small cities.

Material	First cost, sq. yard	Expense per yard per year first period	Average expense per yard per year, 50 years
Granite	$3.50	$0.294	$0.270
Asphalt	2.00	0.208	0.164
Wood.	3.50	0.308	0.274
Brick	2.50	0.224	0.199

The Brick Road and Its Construction[*]

By Jas. McCleary

The question of road building has occupied the attention of the people of the United States for several years. It has been discussed from every viewpoint until people in the remotest areas are familiar with the possibilities of improved roads.

In Ohio, for example, there are 88,000 miles of road, yet the most ambitious of county and inter-county market roads contemplates the improvement of only 9,000 miles. How are the remaining 79,000 miles of highway to be improved if not by inexpensive methods suited to their light travel? Discussing the cost for the more travelled roads, Mr. Frank R. Lander, the Dean of road builders in Ohio, says, "Cheap first cost in road building means nothing more than one of two things, ultimate high cost or complete loss." Cheapness most often stands for extravagance in the end and the adage that "whatever is worth doing is worth doing well" is in striking application to the subject of road building. Yet this false notion of cheapness has prevailed to such an extent that engineers and road builders in Ohio can cite instances where money aggregating millions has been as good as thrown away in road improvements without producing any lasting results, unless to educate the public by experience that ultimate results are more to be desired than cheapness of construction.

A good road can be identified, not by its first cost, but by the amount expended upon it for repairs in proportion to the traffic.

In the matter of grading, I can pass the question of cuts, but a word about fills will not be amiss. Do not place too much trust in a fill which was partially made a generation or two ago. The older portion may be the more treacherous. Perhaps trees and brush were used in making the original fill. If they have decayed, the fill is in a honey-combed condition and likely to give way. The best method of locating voids is by puddling.

Enclose your sub-grade with temporary earth dykes two feet higher than the sub-grade, and divide it into compartments by similar cross dykes. Fill the compartments with water, one at a time, and weakness, if any, will appear shortly. The usual method of relying on a roller for compacting a fill is not nearly so efficacious. In my experience, not more than ten per cent. of the fills could be properly compacted with a roller alone.

Don't fall into the error of thinking that the province of a roller is to purchase a smooth, even, surface on the fill. Rolling, like puddling, ought to help in developing hidden weaknesses where most or different material is needed.

Don't undervalue the necessity of drainage. My rule has been to use it as a precaution in dry places and as a necessity in wet places.

Tile drainage is much better than ditch drainage, but don't place your longitudinal drain beneath the pavement where it is less efficacious in removing the water which the pavement sheds and where, also, it offers a source of back seepage in wet times which may keep the pavement moist and be responsible for shifting in the sand filler. The place for the longitudinal drain is below the gutter. Cross drains should be proportioned in frequency to the nature of the soil and the character of the natural drainage. In some muddy places it may be necessary to lay them every ten or fifteen feet. In other places they will be unnecessary for a considerable interval. The essentials of my practice in under-drainage have been, first, open tile; second, position below the frost line; third, the use of gravel or cinders in filling the trench.

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[*] Abstracted from a paper presented recently before the Northwestern Road Congress, Milwaukee, Wis.

One advantage of under-drainage as compared with a longitudinal ditch is the lessening of danger to traffic and the more level shoulder of earth that can be graded above an underground drain. Such a shoulder can be kept free from tall grass and weeds by means of a mowing machine.

Be careful not to injure your curbing during the later stages of construction. Careless hauling of heavy loads or machinery over an unprotected edge will cause breaks which expose the brick to abnormal wear. This caution has frequently been violated in my observation.

I would issue three warnings with respect to concrete bases; don't use concrete that is not homogeneous; don't tolerate the existence of voids; don't be satisfied with a finished surface that is not uniformly smooth. In addition to these points, one should observe al lthe other cautions that apply generally to concrete mixing.

The value of the first and second warnings is apparent when you consider that the sole object of a foundation is to strengthen the natural bearing surface and transmit the burden widely and uniformly. The third caution is to prevent such projections or depressions in the concrete as shall result in a different depth of sand cushion at different points.

The importance of this feature will be apparent after the rolling of the brick surface is in progress. An undulating surface of brick means a sounding board effect when the pavement is brought into use and a possible breaking of the bond. Mere spreading of the sand is never sufficient. It should be rolled and re-shaped repeatedly until both the surface and the density are uniform. Too often the road builder contents himself with one rolling after which he fills the depressions with loose sand and finishes the surface with a template. Each refilling should be followed by rolling, a hand roller of 350 pounds' weight being most satisfactory. A soft, uncompacted sand cushion will work up between the brick, when the latter are rolled.

In the culling of brick, good judgment is the exception. Many seeming defects, as viewed by the casual inspector, are not defects. The cull pile may well be examined for later decision on some of the brick that were hastily eliminated. Softness is the chief defect to avoid. Kiln marks frequently indicate unusually good brick, because they are due to fusibility and pressure from the weight of overlying brick in the kilns and fusibility means vitrification. Be sure that your brick are used their best side up. Delivery to setter in such a position is recommended. Be sure that the lugs are all in the same direction. The purpose of the lug is to provide a uniform interstice and permit the grout to descend to the bottom of the joint. Laminations are not to be avoided. If you visit a brick plant you will see that the very process of making bricks entails the existence of laminations.

Don't begin your rolling in the centre of the pavement. Roll adjacent to the curb lines, approaching the centre gradually. When the centre has been reached, start at the opposite curb and repeat the process.

Good grouting, like charity, covereth a multitude of sins. No badly grouted pavement was ever a good pavement, but well grouted pavements have sometimes passed muster for considerable periods in spite of gross faults in other details of construction. Three successive applications of a one-to-one mixture of Portland cement and clean sand has been my rule. The utmost care in selecting materials, in supplying the grout and sweeping it into the very bottom of the cracks, will be repaid in results. Anything less than the most exacting care in the application of grout is just like throwing labor and material away.

I dislike to conclude without testifying to my faith in the merits of properly constructed brick roads, based on my ten years' official connection with road building in Cuyahoga County, Ohio. Good brick construction means a highly satisfactory, economical and lasting roadway. Not all Cuyahoga County roads are of this character. It must be borne in mind that Cuyahoga County was the laboratory of brick road experimentation for the whole country and that it made the early mistakes from which other localities, as well as Cuyahoga County itself, were able to profit. In some rare instances, the early lessons were not fully applied in later construction, but take an overwhelming percentage of the mileage in the last ten years and its cost of upkeep can almost be disregarded. Cutting weeds along a rural road may be an item of road maintenance, but it is an expense that has nothing to do with the character of the road wearing surface or its maintenance.

We have roads now bearing a heavy traffic whose first cost is their last cost to date, although they have been down a decade or more. How many decades this state of affairs will continue is a matter that can be only surmised, for, as a government bulletin so aptly states, "no properly constructed brick pavement has yet worn out."

Transcontinental Railway Company's Air-Lift Plant at the New Quebec Bridge

WHAT is claimed to be the largest air-lift plant in the Dominion has been installed by Mr. Wm. Perry, consulting and hydraulic engineer, Montreal, for the supply of water to the Transcontinental Railway Company at the new Quebec bridge.

The water is taken from an artesian well, 1,012 ft. deep, 8 ins. in diameter, and when tested for quantity delivered 5,400 Imperial gallons per hour. Into this well is placed 812 ft. of 3 and 3½-in. pipe, with auxiliary connections. From the ground level a 3-in. Harris pump, connected to a Canadian-Rand drill compressor, delivers the air to the bottom of the pipe. The water instead of being allowed to flow into the tank is trapped into a "booster" and with the air that is collected a pressure of 47 lbs. was obtained. This air forced the water into a tank 88 ft. above ground level, giving a lift of 900 ft. from bottom of pump to top of tank, and delivered over 4,500 Imperial gallons per hour into a tank having a capacity of 70,000 gallons.

The work was done in a thoroughly satisfactory manner by Mr. Perry, who claims to be the oldest pump maker in the Dominion. Since opening his shop in 1851 he made pumping machinery a specialty. Mr. Perry has also installed air-lifting machinery, notably the plant for the Frontenac Breweries Company, with a delivery of 1,500 Imperial gallons per hour. This plant is the only one of its kind in Canada.

Canada Cement Company's plant at Exshaw.

Features of Recent Additions to the Canada Cement Company's Plant at Exshaw, Alta.

(Staff Article)

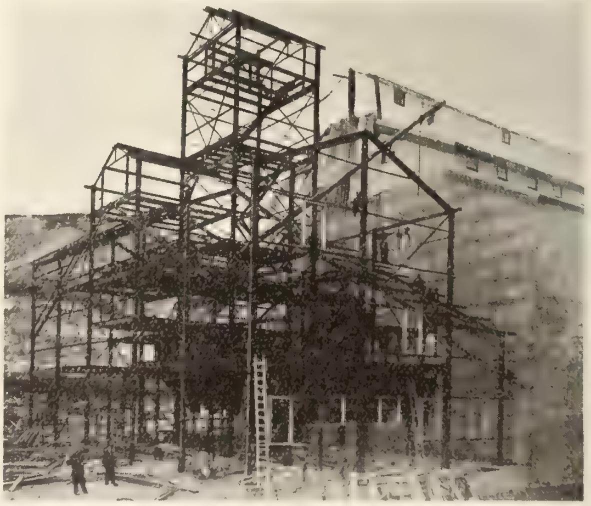
THE Canada Cement Company, Limited, have nearly completed further additions to their mill at Exshaw, Alta. These consist of a second reinforced concrete stock house, a bag-cleaning and storage house, and a packing house. The mill is situated just within the eastern ranges of the Rocky Mountains, sixty miles west of Calgary, on the main line of the Canadian Pacific Railway. It has a daily capacity of 3,000 bbls. About a year ago a reinforced concrete cement stockhouse, having a capacity of 240,000 barrels, was completed, and during the past summer construction was commenced on the structures herein described. The stockhouses occupy a site adjoining the railway, and have a total length of 334 feet, being 100 feet wide over all. Adjoining the existing storage house there is a pack-house and bagging-house 100 feet long, with elevators and bagging hoppers; a bag-cleaning and storage house 60 feet long; and a reinforced concrete stock house 172 feet long having a storage capacity of 100,000 barrels. With the exception of the storage bin, the entire construction is structural steel with galvanized iron siding, carried on concrete foundations.

Cement is received on a belt conveyed from the grinding mill and is discharged on to a belt conveyor running over the bin and into the packing house cupola. Cement may then be discharged by tripper either into the storage bin or into the boot of an elevator leg which lifts it about fifteen feet and discharges on to a belt conveyor running through the cupola of the large storage building. Cement is taken from the storage bins by screw conveyors running in tunnels to the packing house, feeding to elevators which lift it to the hoppers over the shipping floor.

The stock house just completed is covered by a monitor roof, there being eight trusses of 60-foot span, carrying the cupola in which runs the conveyor. On either side there is a lean-to, 20 feet wide, the rafters following the slope of the trusses over the bins. The bag-cleaning house is of the same type of construction, the trusses being carried by steel columns, instead of on concrete walls, as in the case over the bins. The bin walls are heavy, reinforced concrete, with counterforts, the walls being 30 feet high. The bag-house is more complicated in its construction because of the machinery installed. It has a total height of approximately 75 feet, being 58 feet long by 100 feet wide. There is a total of 300 tons of steel in the structures, of which 140 tons are in the packing house.

The erection of the steel was accomplished by means of an open steel guy derrick having a 100-foot mast and an 85-foot boom, with a working capacity of

Cement bin.



Packing house.

Constructional views of the extensions to the Canada Cement Company's plant at Exshaw.

15 tons. In the erection of the steel over and beside the concrete storage bins, the herrick was set up inside the bin at the end nearest the other structures, and steel was then taken from the cars beside the bin and placed on either side for the lean-to and also for the roof, thus accomplishing in one set-up what would ordinarily have required several noves and have been more expensive. The same derrick was used to set the balance of the steel, setting the topmost members without any intermediate lifts, though a smaller derrick boom was seated on the structure for handling light girts and other small members.

The steel was fabricated by The Toronto Structural Steel Company, Limited, Toronto, and was erected by Mr. E. M. Huyck, of Calgary. The buildings were designed by the engineers of the Canada Cement Company, Limited, of Montreal.

Standards for the Turpidity of Water

THE principle used for the preparation of turbidity standards as given in the reports of the Committee on Standard Methods of Water Analysis of the American Public Health Association, 1905 and 1912, i.e., that of correcting a standard determined by weight by the use of a field method, is like hitching the cart before the horse.

No two laboratories nor any two persons in the same laboratory working independently in the preparation of silica standards, following the procedure outlined, will make standards exactly alike.

A field method is never accurate and the description of what is "An observation in the middle of the day, in the open air, but not in the sunlight, etc.," ss a source of many possible interpretations. The amount of light, the size, shape and color of the vessel, the fineness of the material, to say nothing of the personal equation, all influence the results.

What is needed is a definite procedure by which standards can be duplicated from time to time by different chemists without variation.

Such a method has been in use in the laboratories of this bureau since 1901. It involves the use of diatomaceous earth, prepared as follows:

"Wash with water to remove soluble salts; dry and ignite to remove organic matter; treat and warm with dilute hydrochloric acid; wash until free from acid and dry thoroughly. Grind in agate mortar, sifting through 200 mesh sieve and dry in desiccator."

Take a weighed amount of finely ground material, about two grains, suspend in 500 c.c. of distilled water, shaking vigorously from time to time for two or three hours. Suspend for ten hours, decant supernatent liquid. Dry and weigh residue. The difference equals the amount in suspension. Dilute to standard and use as stock.

I have found that standards made in this way from different stocks do not differ perceptibly. All material that remains suspended for ten hours appears to be of the same degree of fineness.

We add a small amount of a saturated solution of mercuric chloride and make standards as follows: Use quart bottles of a high grade of white glass free from air bubbles. The standards are 0, 0.5, 1, 2, 3, 4, 5, 7, 9, 11, 14, 17, 20, 23, 26 parts per million silica. For readings above 26, we use a special nesslar jar with a ground glass stopper. We seal these standards. The 100 c.c. standards are 26, 32, 38, 44, 50, 65, 80, 95, 120, 150, 180. For turbidities above 180, dilutions are made with clear water.

During 1913 we made over 24,000 tests with these standards. We have standards made in 1907 still in use. These have been checked from time to time and have not been found to change. We would not recommend using standards over six months without checking.

This method while it is ideal for the preparation of standards which can always be duplicated, involves considerable labor in the preparation of the diatomaceous earth. The introduction of Fuller's earth seems to be a step in the right direction. I believe this was first brought out by Dr. E. C. Levy, of Richmond, Va., in a paper before the Laboratory Section of the American Public Health Association, although in the report for 1912, he s not given credit for it. The idea, of course, is to do away with the tedious grinding and to obtain a standard which resembles more closely the turbidity of water caused by clay.

Working then with two objects in view, of having a definite weight and a definite degree of fineness (obtained by suspension for a definite period) we have experimented with Fuller's earth and have prepared standards which check exactly with our standards made with diatomaceous earth. Our method follows:

If a 200 mesh sieve is not obtainable take aboue 20 grams of Fuller's earth; if a sieve can be obtained, take about 5 grams of the sifted material (weighing is not necessary). Place in a gallon bottle and add about a quart of distilled water, shake thoroughly, as above, and suspend for ten hours. Decant and determine the weight of the material remaining in suspension by filtering 100-200 c.c. through a weighed Gooch crucible. Dry and weigh.

It will probably be necessary to coagulate the material by the use of a known weight of hydrate of alumina or a solution of alum. In this latter case, the water should be alkaline to precipitate the alum.

The total weight will be the weight of the material in solution plus the weight of the hydrate of alumina.

We know then the degree of fineness as we have suspended for a definite period and we have a known weight. From this suspension we can make our stock for use in preparing our standards.

I do not know just how long the standards will keep, as the period elapsing since their preparation is relatively short compared with our other standards, but in any case it is a simple matter to prepare new ones.

Paper before the [illegible] Association by [illegible] D. West, Chemist in Charge [illegible], Philadelphia Bureau of Water.

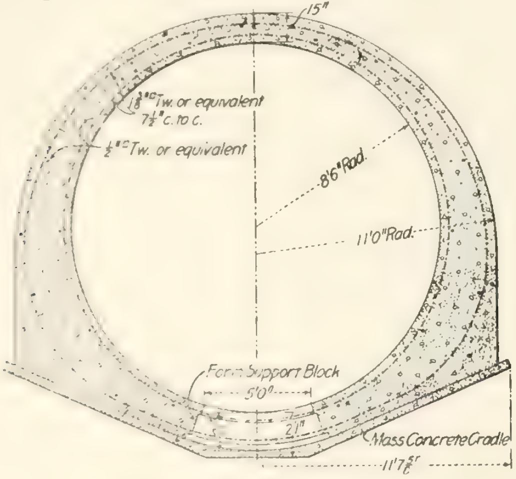
We are all familiar with curves of production plotted as a part of the record of work done; but it is not so common to plot those curves in advance of the work done, and by their aid to smooth out inequalities in the demand for labor, and thus operate the whole plant more effectively. The Aberthaw Construction Company, Boston, has found it possible by this means to avoid letting men go temporarily during a lull in the job, to be followed by the hiring of a large force a week later, to rush some particular part of the work to completion. A long look ahead, aided by the plot, has resulted in keeping the force fairly constant for long periods. This makes the workman feel that his job is reasonably secure during the continuance of the building operation. And the lack of efficiency due to the sudden addition of numbers of untrained hands is at the same time avoided by spreading out the whole work more evenly over the entire period.

Difficulties Encountered in Building a Reinforced Concrete Aqueduct 17 ft. in Diameter[*]

By Geo. T. Seabury[†]

ONE of the many problems involved in building the Catskill Aqueduct, by which New York City's new water supply is to be made available, was the construction of a 3-mile stretch of cut-and-cover conduit capable of carrying 500,000,000 gal. daily under a head of 29 ft. The size of the conduit necessary, because of the allowable gradient, precluded the use of a steel lining, unless that lining were to be assembled in the field. The cost of such a lining would have been a considerable factor. The head that will obtain made a reinforced-concrete structure quite possible, and the necessity of insuring against a deformation that would be sufficient to cause a longitudinal crack and subsequent leakage determined that it be circular in shape. A concrete conduit 17 ft. in diameter and with reinforcement consisting of a pair of rings was evolved.

This massive and relatively simple structure nevertheless possessed some features that rendered its construction particularly difficult and slow. An analysis of the construction details and some of the attending difficulties may be of value both to designers in their study of the elements that cause trouble and to contractors in their efforts to attain the desired result satisfactorily and at a practical cost.



Section of 17-ft. aqueduct.

The effluent aqueduct, so called, is the conduit leading from Kensico reservoir toward the proposed filters. Lying along the margin of the reservoir is the bypass aqueduct. It is similar in design to the effluent aqueduct, but because a steeper gradient is possible the bypass aqueduct is only 11 ft. in diameter and is less heavily reinforced. Through the bypass aqueduct flow to the city may be maintained without the use of the reservoir. The construction problems were common to both structures, but as they were more difficult in the larger conduit attention is here confined largely to that structure.

The interior or waterway is circular, while the exterior is a distorted circle tending toward a horseshoe shape. The transverse reinforcing of the effluent aqueduct consists of two rings of 1⅜-in. square twisted steel rods, the inner ring circular and concentric with the waterway and the outer ring resembling more the outside shape. The pairs of rings are spaced 7½ in. on centers.

In both structures nineteen longitudinal rods of ½-in. square twisted steel are spaced more or less uniformly around the section. In the expansion joints —or contraction joints as they should, perhaps, more properly be called, as it is because of contraction primarily that they eixst—a steel plate 6 in. wide and ½ in. thick is placed around the entire section with a diameter 14 in. greater than that of the waterway and with half of the plate incorporated in each of the two adjacent casts.

The design permitted of no longitudinal construction planes by which an invert might be built in advance of the side walls and arch. It was the essence of the design that between vertical bulkheads the section should be built as a monolith and to this end inside forms were required and concrete blocks provided for their support. It was necessary, therefore, to erect forms completely before any concrete was placed and when the latter was begun to carry it to completion in one operation.

Forms

In the bypass aqueduct Ransome steel telescope forms were provided for the waterway. Each form was 7½ ft. long and was supported at mid-lengths by one of the form support blocks. To facilitate collapsing the forms were divided into four parts. Two symmetrical leaves or segments were hinged at the top in the centre and two others, each consisting of a half of the bottom third of the circle, were hinged to the bottoms of the side leaves. In telescoping, these bottom segments were folded up and then the two top segments, carrying with them also the bottom leaves, were lowered and drawn together, the resulting shape passing readily through the expanded forms.

A portion of the inside forms for the effluent aqueduct was of steel, of Blaw manufacture, and was operated like those of the by-pass aqueduct. On a portion of the former structure the superintendent, feeling that the support blocks were likely to prove a source of leakage, built forms of wood that were supported on I-beams which extended through them near the top of the forms. Between the I-beams and the forms were jacks by which the forms could be lowered sufficiently to telescope. The I-beams in their turn were supported at each end on wooden towers, one of which rested on the completed work and the other on the ground in advance of the work. These forms were in 17.5-ft. lengths and consisted of three leaves, the bottom portion of the circle being one leaf of such a size that it could be swung up and clear the I-beam overhead, as shown in one of the photographs.

The outside forms used in this part of the work were also of wood, consisting simply of frames to which lagging could be nailed as needed. The steel outside forms were ribs made of angles or channels, fitted with plates so arranged that part of them were removable. In all cases the outside forms were held in position by the bulkheads and by tapering bolts tying them to the inside forms. The bulkheads were of wood for use with the wooden forms and for the steel forms were built up of angles and plates. Some of the support block forms were of wood and some were built up of steel and presented no difficulties that careful spading did not readily overcome.

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[*] Courtesy of the Engineering Record.

[†] Formerly Principal Assistant Engineer, Kensico Division, Board of Water Supply.

Assembling Rings

The mode of procedure was to move an inside form into position, resting it upon its support block, and to thread on it the reinforcing rings that would be needed between that block and the next. With the wooden form only one length was used at a time. The next step was the assembling in position of the rings of steel reinforcement. This was accomplished by the use of three separators. Each separator rested against the inside form and consisted of two pieces of wood, of which one had notches to hold the rings the proper distance apart, and from the form, and the other was plain, being simply bolted to the notched block to form a cover. The three separators were arranged with one at the very top, from which the rods actually hung, and one at each side to keep the rings distended. The rods assembled, the bulkhead was put on and outside forms erected.

Recognizing that the placing of the heavy and awkward rings of reinforcing would occasion severe treatment of the steep slopes and the bottom, entailing the alternative of a disturbed foundation or an extensive excavation of the muck, with the consequent waste of concrete, a concrete cradle was designed and was always built first. This was only 4 in. thick and performed no function at all save to act as an armor for the bottom, thus preserving it from damage. This cradle was placed even in the soft and friable schist encountered. The illustration on the front cover of this issue shows the cradle and the support blocks and forms.

It was quite a trick to bend the heavy rods to such a shape that when suspended they would acquire of their own weight the theoretical shape required, and it was only by experiment that it was accomplished. The rods, from 57 to 65 ft. in length, were bent around a template of such a size and shape that when the rods sprang free and were then hung in the separators they took the true shape, which was quite different from that of the template. Rod-bending machines were tried, but because of the necessity of changing the relative position of the rolls for the different radii required, and because these twisted rods took on when in the machine a sort of spiral shape, the more primitive method of a group of men winding the bar around a template was found in the end to be much the more economical.

In the early work difficulty was experienced with the bulkheads, which in their removal loosened the expansion plates in the joints, and at times even cracked and broke off the concrete. The bulkheads as then built were all of steel and provided with a slot which half (3 in.) of the plate fitted. This bulkhead wedged tightly and was almost impossible to remove. This difficulty was corrected by leaving this slot in a false wooden bulkhead inside the steel bulkhead. This permitted the steel to be first entirely removed without difficulty or damage, and then the wooden bulkhead was taken off with ease when the forms were loosened.

There arose another difficulty which was soon very successfully solved. This was most marked in the bypass aqueduct, where the diameter of the inside form was less and its curvature therefore the more abrupt. Removable plates had been provided in the outside forms to allow for the working of the concrete through the openings so made. These doors, however, were so arranged that on account of the curvature of the inside form not all parts could be reached properly, even with curved tampers. There resulted zones of improperly worked concrete that exhibited more or less honeycombing. The outside forms were almost entirely rebuilt before any considerable length of aqueduct was constructed, and they were so arranged that two-thirds of the area was removable in small plates, which had the further advantage that they could be handled by one man and by him placed without delay to the hoisting plant.

The greatest difficulty of all occurred in the effluent aqueduct; this was due to the diameter of the inside form being so great. It did not prove feasible to pass the concrete in through the openings of the side forms, although chutes were provided for that purpose, the idea being to get the concrete to go by gravity as near to the centre of the invert as possible. The concrete was therefore dumped on the top of the inside forms, which at this point were not covered by the outside forms. Here the difficulty of continually cleaning between the reinforcement led to the adoption of a two-pitched roof, which was removed only when the last of the cast was reached. The eaves of this roof were provided with boards which prevented the concrete from tumbling inside except when wanted, and then only in the quantities desired.

The concrete, in falling, separated; the mortar clung to the circular inside form and the stones fell free, hitting the reinforcing and flying in all directions. Much of the stone landed 10 to 12 ft. from where it was wanted, and it was necessary, therefore, to shovel it over to the centre line and there to ram it and spade and poke it back into the mortar. With 1⅜-in. rods spaced 7½ in. on centers this shoveling was done with considerable difficulty, and it was only by the most persistent effort that the stones were again incorporated in the mass of mortar. The men engaged in spading lay upon their backs inside the reinforcing, and it was found absolutely necessary to have the authority of an inspector on each side of the centre line until the invert was well completed and the concrete began to rise on the sides.

Difficulty With Invert

A further difficulty that arose sometimes in spite of the utmost care was an invert that was not at all points in contact with the inside or cover form. When the elevation of the bottom of the inside form was reached the fluid concrete had a width of about 12 ft., and because of the large diameter circle it met the cover form at such an acute angle that as the concrete was pushed toward the centre it sometimes wedged. In effect dams were formed, one on each side of the centre line, and between these dams there was only mortar, which sometimes was insufficient to fill the space. The placing of the concrete at this point was, therefore, a very slow and laborious task. It was necessary practically to suspend delivery for nearly an hour at times in the larger casts, and because of the physical discomfort suffered by the men it was almost impossible to retain those that had been trained to the necessities of the work, even at increased pay. There was practically the equivalent of a new gang each week or ten days.

The lowest longitudinal reinforcing bar was observed to increase the tendency for dams to form and it was therefore moved a few inches to a higher position, a change which helped considerably. Another thing which helped the inspectors very much was to open small tell tale holes in the bottom of the inside form; and vigilance was relaxed only when all of these holes vented mortar of the consistency which experience had shown to indicate a condition that would prove satisfactory upon stripping.

Points of Interest in New Electrolytic Sewage Treatment

LAST March there was installed in one of the sewage purification plants of Greater New York, that known as the Elmhurst disposal plant, in the borough of Queens, a small plant using electricity as one of its principal features, the object being to permit the city officials to study the operation of this process. A description of this plant abstracted from an article in the Municipal Journal is presented herewith. The plant was furnished by the Electro-Chemical Corporation, being the invention of C. P. Landreth, of Philadelphia.

The plant itself was originally constructed for the electrical purification of water and not of sewage, and therefore certain features of it, referred to later, were not best adapted to sewage purification. The nominal capacity of the plant was stated to be 25,000 gallons per day.

In studying any plant for this purpose, the matter of cost is, of course, an important one, and is referred to in these reports, but the company claims that conclusions as to cost based on this plant would not be fair to the plant, since its form was not that best adapted to sewage purification; the plant itself is small and gives a higher cost per unit than would a large plant, and finally no effort was made to keep expenses down to the minimum, the effort of the company being rather to demonstrate the effectiveness of the plant in securing purification without special consideration to saving in operating costs.

The plant is located in the building of the Elmhurst sewage disposal plant, where approximately one million gallons of sewage a day are being treated by passing it through four sedimentation tanks, the effluent from which flows onto one acre of sand filters; the sludge from the tanks being dried upon beds of pea coal in which steam pipes are embedded, coal and sludge being finally burned under the boilers which furnish the power for pumping the sewage into the settling tanks.

The Electro-Chemical Apparatus

The electro-chemical apparatus was placed on a platform over one of these tanks. It consists of a box of cypress 4 feet 10 inches high and 18 x 24 inches in horizontal cross-section. In the bottom of this is a bank of ten carbon plates or electrodes, and above this are four other banks, each consisting of twelve iron electrodes. All of these electrodes are placed horizontal, and the several banks are separated from each other by a space of about 3 inches, while the iron electrodes are spaced ⅜ of an inch apart. These electrodes are made of low carbon steel and are 10 inches by 16 inches by 3-16 of an inch thick. Sewage is admitted in the bottom under the carbon electrodes and passes between the several electrodes, thence between the several iron electrodes in the first bank, across the intervening space and between those in the second bank and so on; the construction being such that the sewage is required to follow this route. Thus every particle of sewage must pass four times between two electrodes which are ⅜ of an inch apart. After passing through these, the sewage leaves at the top of the tank, is discharged into a flume containing a weir, and from this into a sedimentation tank. The effluent from the sedimentation tank falls into one of the four large sedimentation tanks of the Elmhurst disposal plant, the capacity of which is about 68,000 gallons.

Revolving Paddles

Between each two iron electrodes are two paddles which are revolved in opposite directions, one slightly in advance of the other, and thus aid rather than retard the revolution of each other. These paddles are 9 inches long, ¼ inch thick and 2½ inches wide at the centre, tapering to 1⅛ inches at each end. These are revolved by two vertical shafts of ¾-inch steel which are operated by a motor in the base of the apparatus.

Above the carbon electrodes and immediately below the first bank of iron electrodes is a pipe through which a lime solution is injected.

An inessential feature of the plant is a 2-inch centrifugal pump, which lifts the sewage from the channel which feeds the large settling tanks and forces it through the electro-chemical apparatus.

The carbon electrodes are connected in series. In each bank of iron electrodes, alternate electrodes are connected in groups of threes and these groups are connected in series. The carbon plates, on the other hand, are in parallel with the whole set of iron electrodes, so that nine-tenths of the current is taken by the carbon and one-tenth by the iron electrodes. The iron plates are connected so as to be automatically short-circuited to a zinc plate in the top when the operating current is shut off. A volt meter and ammeter at the front of the machine indicate the current being used thereby. When inspected recently these meters indicated 20 amperes and 7½ volts. This has been the rate and intensity of current used throughout most of the test.

A small tank is provided for making milk of lime, and a small plunger pump discharges this into the apparatus just below the iron electrodes, as previously stated.

Distinctive Features

The devices which we claimed to differentiate this process from any other electrolytic or electro-chemical method of treating sewage, are the paddles and this introduction of lime. The former are claimed to prevent polarization, break up solids in suspension and agitate the sewage so as to bring every particle thereof under the influence of the electrodes, keep the electrodes clean from any deposit and mix the re-agents produced electrolytically. It is explained that polarization is due to the tendency of ions to part with their electric charges more or less reluctantly, the positive ions attracted to the negative pole, for example, tending in some degree to remain positive and thus repel the following positive ions which would otherwise be attracted. The effect of the lime will be referred to later. Another feature is that the iron plates are not diminished in volume by the operation, since they are short-circuited with a zinc plate, thus preventing decomposition and the increased resistance in starting the current experienced in using the older devices.

The reports of Messrs. Firth* & Travis† are abstracted below.

The carbon electrodes, being electro-chemically passive, produce hypochlorite, with its sterilizing effect, from the common salt or other electrolytes present. The lime solution is introduced above the carbon plates because if introduced below, the calcium base being more easily ionized than the sosdium base, calcium hydroxide rather than sodium hypochlorite would be liberated.

In other processes using iron electrodes, the electrodes have been consumed by the action of acid ions liberated from the electrolytes and producing ferric hydrate by dissolving the iron electrodes, this hydrate serving as a coagulent. In the Elmhurst plant, sufficient lime is added to neutralize the acid ions and prevent any eating of the iron electrodes. The calcium hydroxide, being readily ionized, liberates nascent oxygen from the hydroxyl, while the positive calcium at the cathode reunites with water to form calcium hydroxide again. In addition to this, a bulky hydrated calcium carbonate is produced which, with any ferric hydrate formed, furnishes a coagulent which settles out in a few minutes, carrying with it most of the suspended matter.

The amount of lime used at Elmhurst averaged about 1,200 pounds per million gallons. Analysis shows the hardness of the Elmhurst water supply to be 102 parts per million, and the lime necessary to overcome this 496 pounds per million gallons. This leaves about 700 pounds per million gallons of lime available after reducing the hardness. It appears that with perfectly soft water the amount of lime might therefore be decreased by about 500 pounds.

The electric power supply is alternating current, 2-phase, 220 volts, 60-cycle. The amount used for a rate of 25,000 gallons a day was 18 to 20 amperes at 7½ volts, or about one-fifth of a horse-power. As stated above, 2 amperes of the total amount go to the iron electrodes and are seriesed eight times, giving an efficiency of 16 amperes on the iron electrodes. It is considered that with an increase of plate area in larger machines, the voltage could be proportionately reduced, and that about 6 kw. should be sufficient to effect as high a degree of purification as attained in these tests.

That the iron electrodes are not decomposed would appear from the fact that after running for two and a half months the sharp edges of the electrodes did not show any signs of wearing away, nor were there any indications of this a month later. Apparently the only reduction in thickness of the plates was that due to fine sand which was deposited on them for the sewage and moved over their top surfaces by the revolving paddles. It is proposed in the regular sewage purification machines to place the electrodes vertical, allowing sand and other heavy matters to settle in the bottom, where they can be drawn off.

A casual inspection shows that a remarkable result of some kind is produced by the process. The effluent from a small sedimentation tank coming out very clear, and that caught immediately [illegible] the electro-chemical machine showing the almost instant formation of flocs of material which settle to the bottom and leave a clear liquid in a very few minutes. Applying lime only in any amount would not, we believe, produce as rapid sedimentation. The effluent in the large tank, which represented the accumulaton of four or five days or more, was very clear, although with a slight yellow tint, and had a very slightly perceptible odor, and that not unpleasant. The same can be said as to the odor from the sludge which was drawn off from the settling tank.

The chemist, Mr. Travis, gives several pages of data containing the results of his analyses, both chemical and bacterial. About six weeks after the plant was started in operation, sewage which originally had a bacterial content of from 1 million to 3½ million, showed 260 directly after electrolytic treatment and 106 after passing through the sedimentation tank; these results being obtained on agar plates, 48 hours incubation. Gelatine plates after 48 hours showed 1,100 bacteria directly after electrolytic treatment and 250 after passing through the sedimentation tank. On July 20, raw sewage showed 20,000 acid-producing colonies per c.c. and treated sewage 2 red colonies on lactose litmus after 48 hours' incubation.

The cost of the process per million gallons is calculated by Mr. Firth to be as follows:

Electricity for electrolysis (not including pumping) at 3 cts. per kw.h.	$4.32
Lime (941 lbs. at $6 per ton, 97% calcium oxide)	2.83
	$7.15

No estimate is made of cost of attendance or of pressing and disposing of sludge, nor of overhead charges.

A larger plant is now being built to be installed at Elmhurst, about 20 feet long and 3 feet square, with vertical electrodes.

Pumping Water by Compressed Air

By Geo. C. Thompson

MANY industrial plants throughout the country experience considerable difficulty in securing an adequate water supply from ordinary sources and are constantly expending smaller or larger sums for the improvement of their impaired supply or the creation of a new source. Ofttimes it is necessary to resort to the expedient of boring an artesian or deep well in those sections where underlying water strata are known to exist. In such sections there are usually more than one stratum to be found at variable depths, having a channel through rock crevices or "faults" or more commonly in a startum of sand. Where the various water strata are definitely fixed by operating wells and the quality and quantity of water being secured is known, it is comparatively easy to determine to which stratum the well should be drilled.

There are two classes of wells, the artesian or flowing well and the deep well; the majority of wells are the deep or pumping wells, the water rising to some distance below the surface. The height to which the water rises is known as the static head of the well. The static head is variable, even with wells in proximity to each other and it is therefore necessary to install some type of pumping device to force the water to the surface. For this purpose, after long experiment and experience, two well founded and practical systems have been devised; the deep well pump system and the air lift system. Of the two systems this article proposes to deal with the test of an air lift system in a deep well at the North Montgomery, Ala., works of the Morris Fertilizer Company.

The depth of the well in question is [illegible] ft. and the source of supply lies in a 16 ft. stratum of sand. The well is cased with standard 6-in. drive pipe for 383 ft. In order to prevent the sand from obstructing and filling in the drilled hole below the end of the drive pipe, a 20-ft. brass strainer was "washed" in, having attached at the top, 15 ft. of 4½ in. black pipe with a lead collar for packing off to the 6 in. drive pipe in order to perfect a water tight joint.

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* Engineer of [illegible], Borough of Queens.

† Chemist, [illegible]

The equipment available for the test was a 30 h.p. portable boiler, a 10 x 10 x 10 in. steam driven air compressor. An ordinary hot water or range boiler with a 100 lb. pressure gauge was used as an air receiver. Having connected this equipment, a line was dropped into the well and the static head was ascertained to be 41 ft. below the surface.

Three principles of applying the air lift may be used.

First: Forcing air into the well, provided the drive pipe or outer casing is air and water tight in the well, around the outside of the water or eduction pipe. See Fig. 1.

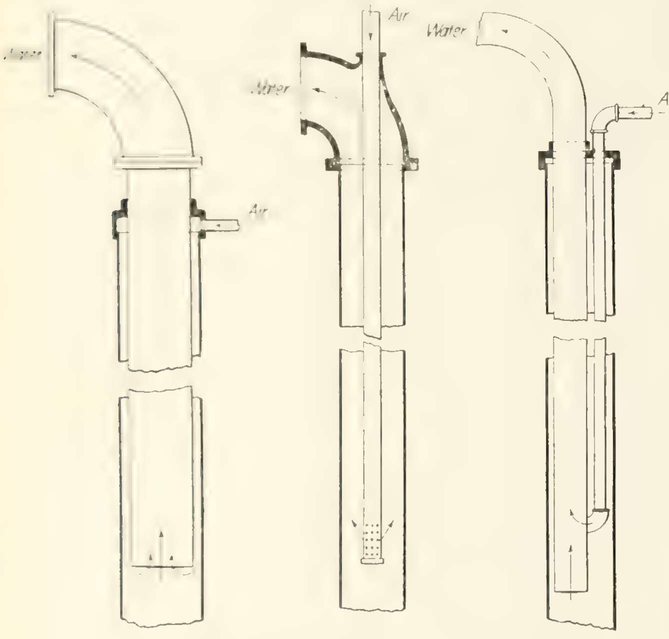

Fig. 1 Fig. 2 Fig. 3

Three methods of constructing an air lift.

Second: Forcing air through a pipe placed within the education pipe. See Fig. 2.

Third: The running of an air line between the eduction pipe and outer casing to a point near the bottom of the eduction pipe, where it is tapped in. See Fig. 3.

For reasons of economical operation it was decided to utilize the principle known as the Pohle system, Fig. 3, but before making the installation it was necessary to consider the elementary principles of the air lift. First, the air and eduction pipes must descend to such a distance below the static head water level as will provide the desired quantity of water commensurate with the ability of the well to deliver it. Each well in this particular must be treated independently and separately. Second, the diameter or area of the education pipe must be in proper proportion to the diameter and area of the air line. That is, a proportionate displacement must be made within the well casing, regardless of the air pressure, for without this, aeration is likely to occur, the air ascending to the surface through the water in bubbles. The volume of water and air admitted for passage through the eduction pipe must be properly balanced. While there are no absolutely fixed ratios for calculating the proper displacement, for ordinary practice, the area of the air line should be approximately one-tenth the area of the eduction line. For example: With an air line of 1 in. diameter whose area is 0.7854 sq. in. the eduction line should be 6 in. diameter, with an area of 28.27 sq. in.

Placing this air line either inside or outside of the eduction pipe, produces an impracticable installation, as in the former case the ratio of displacement is 1 to 35 and in the latter 1 to 36. The correct proportion would be, applying usual stock sizes of pipe carried by the smaller supply houses as follows: Air line 2 in. diameter, area 3.14 sq. in.; eduction line 6 in. diameter, area 28.27 sq. in. The ratio in this case is 1 to 8.9, which while it does not comply with our rule of approximate displacement of one-tenth, provides a satisfactory installation.

Having decided upon the method of applying the air lift to this well, it was now necessary to ascertain the quantity of water the well would yield per foot drafted down as upon this basis could be calculated with reasonable accuracy the total capacity of the well. From the data thus obtained there could be devised an installation that would give the desired quantity of water. Two means of ascertaining this in formation are available: (1) by pumping into the well a given quantity of water in a certain time, or (2) by lifting out a quantity to be measured. Of the two methods, the latter is considered the most accurate and was therefore adopted. With an arbitrary percentage of submergence, the Pohle system was installed. In order to secure the full efficiency of the air available a nipple was screwed upon the inside of the eduction line at the point where the air line tapped in and was turned upward in order to force the air under the column of water between this point and the surface of the water. Later, this practice was found to be wrong, owing to the sand and silt which was in suspension while pumping settling into the elbows when the air pressure was removed, thus forming a permanent obstruction in the air line which no amount of available air pressure would remove, but on the contrary only packed it more securely. This defect was corrected by drawing up the line and putting in a sweeping elbow fitting.

For the eduction pipe, 252 ft. of 3 in. black iron pipe was installed, tapped 16 ft. from the bottom by a 1 in. air line. To measure the water discharged a weir was constructed provided with a blow box and three splash boards to prevent undulations or waves interfering with accurate measurement at the discharge. A square knife edge opening was cut with exceeding care as to accuracy. Three feet above this opening, a nail was driven in the side of the weir at the same level as the bottom of the discharge opening. Around the nail a piece of tin was tacked hemispherically to further prevent any ripples interfering with the measurement of the depth of water flowing through the opening.

Having made all necessary arrangements, the starting pressure required was calculated by comparing the depth of the submergence in feet to the number of pounds air pressure required to raise one foot of water. 0.434 lb. air pressure will raise one foot of water; our submergence in this case deducting the height of static head to the surface and the length of the eduction pipe below the point tapped in by the air line, was

252 ft. — 41 — 16 = 195 ft. submeregence
195 ft. × 0.434 lb. = 84 lb. starting pressure

With a steam pressure of 95 lb. gauge and an air pressure of 85 lb. the compressor pumped 65.448 cu. ft. air per min. When the air was released upon the well the flow began almost immediately. The quantity of water between the static head and the point at which the air line was tapped in, flowed in practically an unbroken stream, after which the flow became intermittent, a "chunk" of water and then air in a pendulum line manner. The starting gauge pressure was 79 lb. and immediately after the flow began dropped to a working pressure of 45½ lb. gauge.

After pumping for an hour, our measurement was taken from the weir and the flow through the 15 in. opening was ascertained to be 9-16 in. or 88.25 gal. per min. to which was added weir leakage of approximately 1 gal. or a total flow of 89.25 gal. per min.

It was observed that the difference between the starting and working pressure was 33½ lb. From this information and also considering the quantity of water secured and the yield of water per foot it is evident that the water is drafted below the static head. Having already calculated that 0.434 lb. air pressure is required to raise one foot of water, then 2.31 ft. of water is raised by 1 lb. of air pressure. It was therefore calculated: 33½ lb. air × 2.31 ft. = 77.38 ft. drafted. This figure includes the pipe friction which must be deducted to ascertain the exact depth and yield. The friction head in this case, pumping 89 gals. per min. 236 ft. through a 3 in. pipe, was approximately 2.54 lb. air pressure or 5.88 ft. Therefore the actual pumping head was 77.38 ft. + 41 ft. — 5.88 ft. = 112.5 ft. below the surface and the yield in gal. per foot drafted was

$$\frac{89}{77.38 - 5.88} = 1.24 \text{ gal.}$$

The well now stands: static head 41 ft. from surface; pumping head 112.5 ft. from surface; yield, 1.24 gal. per foot drafted; percentage of submergence 47.5. Thus to secure 125 gal. per minute, we must draft 125 ÷ 1.24 = 100 ft., and the total head would be 100 ft. plus 41 ft. static head, or 141 ft. From experience it has been found that for a lift of 141 ft. the proper percentage of submergence of the eduction pipe is 55 (see table) or 182 ft. The eduction pipe and air line should then descend to a total depth of 323 ft., air escaping around the outside of the eduction line.

The same size eduction pipe is maintained, but in order to reduce the friction in the air line, its size is increased to 1¼ in. to a point 10 ft. above where the air line taps the eduction line and on account of lack of room between the 6 in. drive pipe casing and the eduction pipe it is found necessary to allow this section to remain 1 in. A condition of this kind should be avoided wherever possible.

The installation is now all complete for delivering 125 gal. of water per minute to the surface. The size of equipment necessary for operation is as follows: The lift of 100 ft. requires 0.48 cu. ft. per gal. of water (see table). The volume of air necessary will therefore be: 125 gal. × 0.48 cu. ft. = 60 cu. ft. per min.

The starting pressure required will be the number of feet submergence, less the static head multiplied by the pound pressure required to raise one foot of water, plus friction in air and eduction lines: 282 × .434 + 8.2 = 130.5 lb. The working pressure, including friction in both air and eduction pipes, is 62 lb. It is readily observed from the foregoing that a standard slow-speed, high-pressure air compressor with a piston displacement of 75 to 80 ft. per min. is required, allowing 20 per cent. and 5 per cent. for the volumetric efficiency of the compressor, for which if belt driven 25 h.p. should be provided.

AIR LIFT TABLE

Lift in Feet	Submergence in Feet	Percentage Submergence	Actual Air Per Gal.	Lbs. Air Pressure Not including friction
20	39	66	.20	17
40	71	64	.26	32
50	86	63	.30	39
60	98	62	.35	44
80	120	60	.41	54
100	138	58	.48	62
125	159	56	.60	71
150	184	55	.68	83
175	206	54	.74	93
200	221	52.5	.80	100
250	250	50	.96	112

Injection of Cement Grout Into Water-Bearing Fissures

By Francis Donaldson, New York

THE direct injection of cement grout into water-bearing fissures as a means of checking or stopping the flow of water into shafts and tunnels has been experimented with for a decade or longer, and seems to have been first attempted in Europe. It is only lately, however, that the process has been entirely successful. This success has been accomplished on the Catskill Aqueduct, now under construction by the city of New York. This aqueduct includes a number of deep pressure tunnels, reached by shafts for both waterway and construction purposes. In portions of these shafts and tunnels considerable underground water was met. The contract for the first of these tunnels was let to the T. A. Gillespie Company; this section is known as the Rondout syphon. It leads under the Rondout valley at a depth of from 400 to 800 ft., and is about 5 miles long. The engineers expected that considerable water would be encountered, but fortunately this was not the case except at one shaft, known as No. 4, which penetrated the rock at a junction between limestone and conglomerate.

Water-bearing fissures were encountered almost immediately. At a depth of about 200 ft. a flow of 1,500 gallons per minute was struck. The shaft then contained as many pumps as could be used, and it seemed impossible to sink it further. After vain efforts had been made to proceed, John P. Hogan, a division engineer of the Board of Water Supply, suggested that a cementation of the fissures be tried. The process was attempted for the first time in this country.

Since the shaft was partly full of water it was necessary to drill grout holes with a diamond drill. Platforms were placed on the timbers at the water level, the diamond drill was installed, and six 90-ft. holes were drilled in the bottom of the shaft. Several carloads of cement were pumped through these holes into the fissures, the drill casings being used for grout pipes. This largely cut off the flow of water from the bottom and sinking could then proceed. After that, water-bearing seams were grouted as soon as encountered, and the contractor was able to finish the shafts and tunnel within the contract time. Shaft No. 4 was a rectangular, timbered construction shaft with no concrete lining; consequently it was impossible to cut off any of the water coming in from above the point where grouting was first attempted. On this account large

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volumes of water had to be pumped until the tunnel was finally sealed.

At the next wet shaft the writer had to do with advantage was taken of the experience gained at shaft No. 4. At this second shaft, No. 4 of the New York City syphon, good progress was made until a depth of about 100 ft. was reached. The first hole drilled in the bottom below this depth struck a stream of water; the flow amounted to about 150 gallons per minute. This was plugged. It was found that each of the twelve holes in the sump cut encountered the same stream of water.

As soon as each hole cut the water-bearing seam it was plugged with a tapered wooden plug. After all the holes in the sump had been drilled and plugged in this way the grout connections were made one at a time, so as to restrict the flow of water into the shaft. Each connection was made with a piece of 2-in. or 2.5-in. iron pipe about 3 ft. long, threaded at one end and given a long taper at the other. The tapered portion was made rough on the outside by nicking it with a chisel. A heavy iron stopcock was screwed to the pipe, the tapered end wrapped in several thicknesses of burlap, the wooden plug removed from the drill hole and the tapered pipe driven in, the stopcock being left open. This was the most exciting and the wettest part of the job. After the pipe had been driven in hard the stopcock was closed.

The Grouting Machine

In this case connections were placed in all the wet holes before grouting. The grouting machine or tank used on the aqueduct was the Caniff machine, in which the grout is mixed by air. It is built like an air lock with a door on the top through which cement, sand, and water are introduced, and has a 2-in. discharge opening in the bottom and air connections top and bottom. The discharge opening is connected to the grout hole by a heavy rubber hose. Another 2-in. stopcock is placed at the outlet of the tank, and a 2-in. by 1-in. tee is placed between the hose and the cock attached to the pipe in the drill hole. Into the side opening of this tee a 1-in. stopcock is screwed.

The machine is installed at the bottom of the shaft, and is connected to one of the holes and also to the high-pressure air supply. The 2-in. stopcock on the machine is closed and the other is opened. The door in the top is opened, a sack of cement, three or four buckets of water, and (if the cavity to be filled is large) a sack of fine sand are poured in, the air connection at the bottom is opened and the air allowed to bubble through and mix the grout. Then very quickly the door is closed, the lower air connection is closed, and the discharge connection and the upper air connection are opened, and the air enters and drives the grout into the cavity. A man stationed at the 1-in. stopcock keeps opening it a crack; when air shows instead of grout he closes the 2-in. stopcock and the machine is recharged. If the cavity is open the charge is pushed in in three or four seconds. By working continuously more than 1,000 batches can be placed in twenty-four hours.

The grouting of the fissure was successful and sinking was resumed. About 50 ft. further down another water-bearing fissure was drilled into, and this, instead of being open, was filled with sand formed by the crushing of metamorphic gneiss due to folding; this sand was carried up out of the drilled holes in large quantities by the water. Grout will not permeate sand, and it was necessary to continue drilling holes and pumping in grout, increasing the pressure at the end from 100 to 400 and 500 lbs. to the square inch. The sand was tamped so full like sandstone and contained balls of grout from the size of a fist to as large as a man's head.

The most difficult grouting on the aqueduct was done on the Hudson syphon, which is a deep syphon tunnel under the Hudson river at a depth of 1,100 ft. below tidewater. The shafts were sunk by the city forces, after which the contract for the driving and lining of the tunnel and lining the shafts was let. About 150 ft. from the foot of the east shaft the heading cut a water-bearing fissure which flowed about 300 gallons per minute. The full flow did not develop until the cut was blasted. The problem then was to grout this flow against a hydrostatic pressure of 500 lbs. per square inch, with no solid rock to which to make grout pipe connections. This problem was finally solved by the construction of a concrete bulkhead 8 ft. thick across the full section of the head. The concrete was mixed in proportions of 1:2:4, and was heavily reinforced with rails set into holes drilled laterally into the sides, roof and floor of the tunnel. Grout pipes leading into the fissure were set through the bulkhead. After the concrete had set for a week, grout was forced into the fissure, first by the pneumatic process with a high pressure air compressor, and finally by means of a high pressure plunger pump which forced water instead of air into the grout tank. Pressures were reached in this way up to 1,000 lbs. per square inch.

In driving or sinking through rock containing a large number of seams carrying small quantities of water, it is not practicable to stop and grout each seam as described above. In this case it is advisable to increase the section of tunnel or shaft sufficiently to allow for a heavy concrete lining. Drains should be provided opposite all the water-bearing fissures to carry off the water while the lining is being placed. After the concrete has secured sufficient strength, the drains may be grouted. By a combination of these two methods it should be possible to penetrate any firm rock, no matter how much water it contains.

Wind Stress on Roofs

Contributed by G. D. Mills

THE consideration of the force which the wind exerts on a roof slope is one of grave importance when the roof is steep. While there is a diversity of opinion held by engineers, relative to the method by which this force should be determined on different slopes, the ultimate results arrived at do not differ widely. It is conceded that wind usually blows in a horizontal direction, but it is assumed that the effect on the roof is perpendicular to the slope, and that the maximum force exerted horizontally, in a violent hurricane, never exceeds 40 lbs. to the square foot of roof surface. It is also evident that the full effect of this force will be realized on a very steep roof or a slope having an angle of 60 deg. with the horizontal, while a comparatively low slope cannot offer a great amount of resistance to the wind. Wind pressures cannot be determined with any degree of accuracy. Refinement in this direction seems to be more a matter of good judgment than of elaborate calculation.

The generally accepted formula for determining wind pressures on roof slopes is Unwin's or Hutton's, but it is necessary to use Logarithms when applying it, and its use is therefore restricted to those who can readily apply a table of Logarithms in the calculation. The formula reads as follows:

Normal Pressure = Horizontal Pressure sin. c. (1.84 cos. c — 1).

In which

Normal pressure = pressure at right angles to slope

c = angle between chord and rafter of roof (1.84 cos. c. — 1) is the exponent of sine c.

From the conceded maximum horizontal wind pressure of 40 lbs. per square foot the formula reads:

$$\text{Normal pressure} = 40 \sin c^{(1.84 \cos c - 1)}$$

The results obtained by the application of this formula can be duplicated closely by simple graphics, described in Fig. 1, which may be applied direct to the elevation of the roof in a few moments, without any calculation whatsoever.

The graphics are applied as follows: Erect a line vertical to the slope, as a.e., also one parallel to the roof chord as a.b., set the dividers to 40 on some convenient scale, and commence at point "a." From a to b, from b to c, from c to d, and from d to e. If a.e. is measured with the same scale the dividers were set to, it will record the number of pounds per square foot of wind pressure vertical to the slope, and duplicate closely the results obtained by applying Unwin's or Hutton's formula within a small fraction, in all the roof pitches, from 1/6 pitch to a 60 deg. roof.

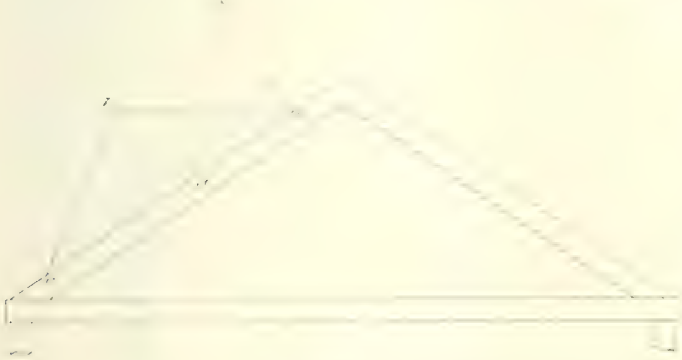


Fig 1

In order to compare the operation of the graphics with the Unwin or Hutton formula, I have devised a formula from the graphics, which is derived as follows: The angle at a is equal to the angle between the chord and rafter of roof — the alternate angles are equal (Euclid I, 29) and the angle at c is equal to the angle at a because a b is equal to b c (Euclid I, 5), and a c equals 40 x cos c x 2. But of b c were extended until it intersected the vertical leg of the right angle, the extended line would be equal to b c (Euclid III, 31), and therefore a c = 80 x cos c. The length a d is found by deducting 40 from a c and a e can be determined by Euclid I, 47, $a\,e = \sqrt{d\,c^2 - a\,d^2}$, from which we may write the formula

$$\text{Normal Pressure} = \sqrt{40^2 - (80 \cos c - 40)^2}$$

Following will be found a Wind Stress Table of the pitches in more general use. The angles are derived from the tangents, tangent [illegible] 1/6 [illegible] .33333 = tangent [illegible] [illegible], etc. The results for the Unwin or Hutton formula and also the graphics have been calculated with a table of five place Logarithms.

A 60 deg. roof limits the operation of the graphics because in Fig. 1 at 60 deg. all sides of the triangle a b c are equal, therefore c d is equal to a c and d e falls on the line vertical to the slope. The limiting angle 57 deg. — 4 ft. — 40 in. in operation of the Unwin or Hutton formula is found as follows. The logarithm of 1.84, which is 0.26482, is deducted algebraically from .1 in order to determine the logarithm of the cosine, which is 1—.73518, and the sum of the two logarithms equals logarithm 0.00000 = 1. The remaining operation is 1 minus 1 plus x 40.

It is interesting to note the small difference which exists in the variety of roof pitches, between the generally accepted Unwin or Hutton formula, and the graphics. The graphics express all that was intended in the Unwin or Hutton formula with an even greater degree of accuracy.

WIND STRESS TABLE

Pitch	Tangent	Angle	Sine	Cosine	Normal Pressure Unwin or Hutton lbs.	Normal Pressure Graphics lbs.
1/6	.33333+	18°-26′	.31618	.94866	17.	17.6
1/4	.5	26°-34′	.44724	.89438	23.8	24.5
1/3	.66666+	33°-41′	.55464	.83214	29.2	29.9
1/2	1.	45°	.7071	.7071	36.	36.4
2/3	1.33333+	53°-8′	.80004	.59996	39.1	39.2
3/4	1.5	56°-19′	.83214	.55464	39.8	39.7
		57°-4′-40″		.54348	40.	
		60°		.5		40.

Concrete "Lumber" for Mine Shafts

FIVE shafts on the Mesaba Iron Range under construction last summer by the Oliver Iron Mining Company are lined with concrete sets and five new power plants to operate the shafts are being constructed of concrete building blocks. These shaft sets and building blocks are made at a central cement products plant at Hibbing, Minn., and shipped to the different mines, a maximum distance of 90 miles. The plant consists of a crusher, bucket elevator, revolving screen, one concrete mixer, one concrete block machine, a pocket divided into three divisions, one for sand, one for gravel, and one for "over-size," two steam rooms, and a casting room equipped with an overhead travelling crane.

Handling Concrete Materials

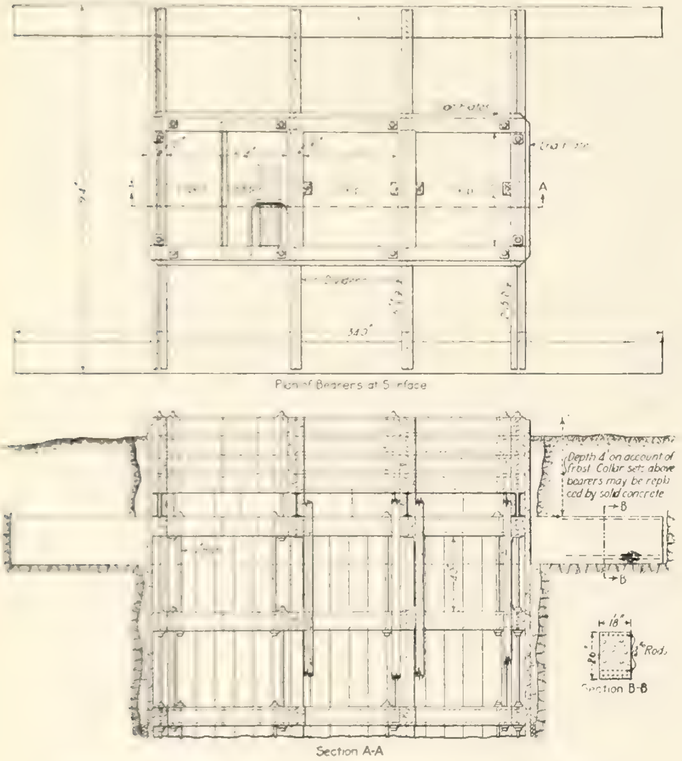
Cement required is delivered in railroad cars on a trestle at an elevation of 21 ft. above the casting room floor, and is unloaded directly from the car onto the cement storage floor. Sand and gravel are obtained from stripping the Sellers' Pit, a distance of about 1 mile from the plant. This material is loaded on stripping cars with a steam shovel and hauled to a large stockpile near the plant. From the stockpile the material is again loaded on small cars, trammed by hand and dumped into the crusher. The product from the crusher is discharged onto the bucket elevator which raises it to the cylindrical revolving screen perforated with ⅜-in. diameter holes in the first section and with 1-in. holes in the second. All aggregate passing the smaller holes is termed sand and that passing the 1-in. holes is termed gravel. "Over-size" is returned to the crusher for recrushing or it may be used for foundation work.

From the bin the aggregate is loaded from spouts and brought to the mixer in a charging car divided into three sections to hold the required amounts of sand and gravel. Cement is poured into the car from sacks before discharging into the mixer. The mixed concrete is poured from the mixer into a distribution car; thence through a chute to the block machine, or it is dumped directly from the mixer through a chute into a car on the mixing floor and trammed by hand to the casting room where it is poured directly into the steel forms for making concrete sets.

Shaft Members

The shaft members are cast in steel forms to shapes of exactly the same dimensions as timber sets for the same size of shaft. Thus no changes are necessary in the various standards of equipment worked out in the different wood-lined shafts which are already constructed. The reason for using concrete sets instead of timber is to eliminate fire risk and to insure permanence. In the ordinary wood-lined shafts it has been found that the timbers soon decay, and after 4 or 5 years the shaft requires continual repairs.

Each shaft set consists of two wall plates, two end plates, each 12 ins. square, two dividers, 10 ins. wide and 12 ins. deep, eight 9 x 9-in. stuttles, and fifty-six 4 x 12-in. slabs for lining. The sets are spaced on 5-ft. centres. Each set is hung from the one above by twelve 1½-in. bolts. At intervals of a maximum distance of 80 ft. steel bearers, consisting of a single 12-in. I-beam under each centre divider and two 12-in. channels (spaced 2 ins. back to back to allow the hanger bolts to pass through) under the end plates, are placed to carry the weight of all sets above. In calculating the weight to be imposed on these bearers no account is taken of the side pressure from the shaft.


Plan of Bearers at Surface
34'0"
A
Depth 4' on account of frost. Collar sets above bearers may be replaced by solid concrete
B
18"
Rods
Section B-B
Section A-A

Concrete slab lining behind concrete sets of mine shaft in Minnesota.

Starting at the collar of the shaft, the first bearers are supported by two reinforced concrete beams, 20 ins. wide by 30 ins. deep. These beams are placed not less than 4 ft. underground to form a foundation to carry the first section of shaft lining.

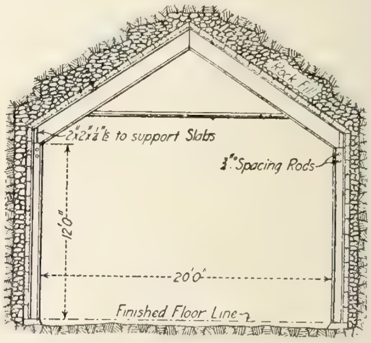
The cost of concrete sets laid down at the shaft ready for lowering is about twice as much as for timber sets, and the labor of installation is increased but slightly, due to the additional weight.

The five concrete-lined shafts and power plants are located at the following mines: Philbin mine at Hibbing, Duncan mine at Chisholm, Wanless and Shiras mines at Sharon, and Minnewas mine at Eveleth. Each of these shafts is about 200 ft. deep.

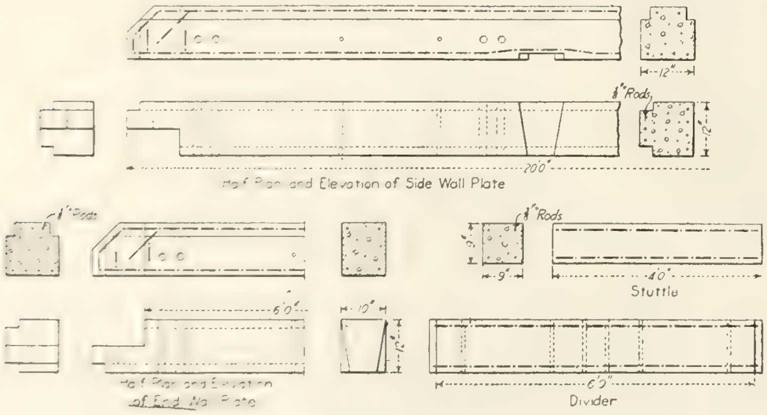
Underground Pumping Station

The company has constructed successfully an underground pump station at the Leonidas mine, consisting of steel supports spaced on 4-ft. centres and concrete slabs for lining the walls and roof. The station is 438 ft. below the surface and accommodates two crank-and-flywheel Prescott Corliss pumping engines and one compound direct-acting Prescott relay pump. The steel sets comprise uprights of 8-in. I-beams placed on 4-ft. centres, 15-in. I-beam rafters and a bottom chord of angles 2 ft. above the top of the uprights to increase the head room. All field connections are bolted. Concrete slabs, 4 ins. thick, 12 ins. wide and 4 ft. long, reinforced both sides for a pressure of 350 lbs. per square foot, are placed horizontally and backed with broken rock tamped in. At the top of the uprights blocking is carried back to solid rock.

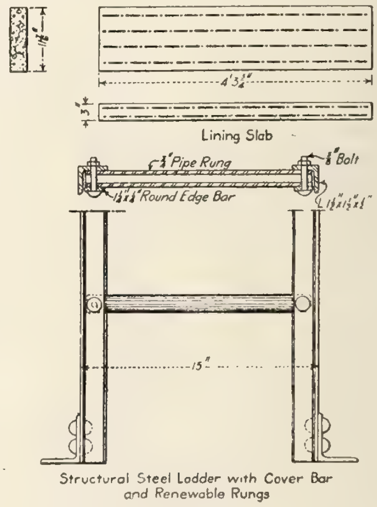
Waterproofing was accomplished by dipping the



UNDERGROUND PUMPING STATION


12"
Rods
20'0"
Half Plan and Elevation of Side Wall Plate
Rods
9"
4'0"
Stuttle
6'0"
10"
Half Plan and Elevation of End Wall Plate
6'0"
Divider

Details of the separately moulded concrete "lumber" for shaft bracing.



Details of ladder and lining slab.

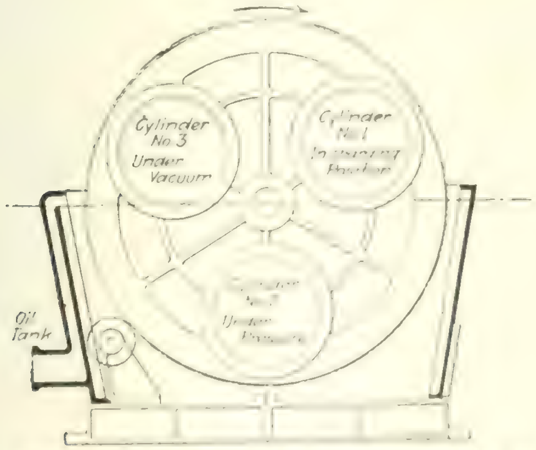
slabs in hot tar and setting them in neat cement. Tar paper was used to carry off the water, which fell in sheets, until the cement could set. Two coats of white cold water paint were applied after the slabs were in place. A recent inspection disclosed a perfectly dry underground station.

The cement products plant is operated under the supervision of the general superintendent of the Hibbing District. Work at the shafts is directed by the general superintendents of the districts in which shafts are located. Designs were prepared in the office of the chief engineer of the company at Duluth, Minn.—Engineering Record.

A New Type of Creosoting Plant

A CREOSOTING plant of novel type now being tried in Scotland has as its special features an entirely new design of the treating plant, a very high pressure for this impregnation. The retort consists of three horizontal cylinders 33 in. diameter and 28½ ft. long, mounted between two end plates or disks which have openings to receive the cylinders and are carried by a central longitudinal shaft. The entire machine is immersed in an oil tank which is kept filled to the level of the shaft. The general arrangement is shown in the accompanying cut. The end plates are driven intermittently by gearing in such a way that every four minutes the retort revolves through an angle of 120 deg. The movement occupies 18 sec., the retort being then at rest for 3 min. 42 sec.

In the first position, with two of the cylinders above the level of the tank, the cylinder at the right is in line with the feed trough (above the end of the tank) and a charge of 24 ties is pushed in by a ram. The frame then revolves (clockwise) 120 deg., immersing the cylinder in the tank. After 60 sec. (to allow the fluid to completely fill the cylinder), sealing pistons move out and close the ends of the cylinder in 12 sec. A pressure of 400 to 500 lb. in the cylinder is then raised by pumps in 12 sec. and maintained for 2 min. 6 sec., followed by a release in 12 sec., completing the 4-min. period.


Cylinder No 3 Under Vacuum
Cylinder No 1 In Charging Position
Cylinder No 2 Under Pressure
Oil Tank

Sectional elevation of revolving type of retort for creosoting ties

The frame then revolves 120 deg., bringing the cylinder out of the tank (and immersing the second cylinder). Other sealing pistons now close the ends while a vacuum is created to withdraw a proportion of the creosote. The frame then revolves through 120 deg., completing its revolution, when the charging ram pushes in a new charge of ties, thus pushing out the treated ties at the other end. The operations are the same with each of the three cylinders, so that at each 4-min. interval a charge of 24 treated ties is ejected.

The partial recovery of oil from the wood is one of the features of the system (which is termed the "save-oil" system), and a series of tests of this process and the full-cell process showed results as follows:

	Save-oil process	Full-cell process
Average increase in weight per tie .	21.22%	30.50%
Average creosote per cu. ft.	7.04 lb.	9.97 lb.
Average creosote per tie	2.18 gal.	3.09 gal.

The plant can be adapted, however, for the full-cell creosoting process or for the zinc-chloride process, the vacuum treatment being then omitted. The operation is continuous and rapid, and gives an output of 360 ties per hour. The plant is compact and occupies comparatively little space, but has considerably more machinery than a plant of the ordinary type. It works also on the principle of high pressure maintained for a short period, the actual pressure period being but a few minutes instead of several hours. However, the amount of oil forced into the wood is said to be greater than by the ordinary process. Ties, poles, bridge timbers and paving blocks can be treated in the same way.

The new process and plant are owned by the Save-oil Creosoting Company, Dickson Street, Glasgow, Scotland. Experiments were made first at the Royal Technical College, Glasgow, and as a result of these a complete plant has been erected at the creosoting works of the Glasgow and Southwestern Railway.

The problem of durably tight joints was paramount in the design of the pipe castings adjoining the 66-in. diameter section valves in the city tunnel of the Catskill Aqueduct, according to the 1913 report of the Board of Water Supply of New York City. Research did not reveal any gasket satisfactory for the purpose except wire cloth coated with red-lead paste. After experiments in the laboratory, it was decided that two layers of 40-per-inch mesh bronze wire cloth coated heavily with red lead would make a satisfactory gasket, if the paste were allowed to set properly. The alternative was ground joints; but no precedent for them with diameters of more than 30 in. could be found. It was decided, however, that if a 30-in. joint could be made successfully, 8-ft. joints could be also, and as a result they were specified for some of these castings.

Announcement is made of the death on active service of a son of Lord Cowdray, President of the well-known London contracting firm of Messrs. S. Pearson & Son, Limited. In railway and engineering circles all over the world the name of Lord Cowdray's firm is esteemed for its ability and integrity. Lord Cowdray himself has built railways and pioneered many important commercial schemes in various parts. Sympathy with him in his present bereavement is world-wide in constructional circles.

The Dominion Government has appointed a special committee to enquire into the development of iron ore mining in Canada. In this connection owners or operators of iron ore property are requested to facilitate this enquiry by communicating with the Deputy Minister of Mines, Ottawa, or the secretary of the committee, Mr. J. McLeish, who will furnish a schedule of questions covering the information required by the committee.

Abstract of an article in The Engineer of London.

Personal Mention

Mr. Jack McDonald, a bridge builder at Hope, B.C., died in a Vancouver hospital recently as the result of a fall.

The Canada Gazette announces officially the appointment of Mr. R. S. Gourlay and Mr. John Laxton as Harbor Commissioners of Toronto.

Mr. A. W. Wheatley, general manager of Canadian Locomotive Company, has left Kingston, Ont., on a business trip to England. It is assumed that he will endeavor while abroad to obtain contracts from several European countries.

Mr. H. S. Van Scoyoc, of Montreal, who has been appointed chief engineer of the new highway to be constructed between Toronto and Hamilton, has had a wide experience in building highways in Canada and the United States. In addition to constructing roads in nearly every province of the Dominion, he was for five years engaged on municipal work in the United States, most of this period being engaged on permanent highways. The new Toronto-Hamilton road is to be constructed of concrete, and Mr. Van Scoyoc has for some time specialized in this form of construction. He has also had some experience in railroad building. Mr. Van Scoyoc is a graduate in civil engineering, an Associate Member of the American Society of Civil Engineers, and a Member of the American Society of Engineering-Contractors, the American Road Builders' Association, and the American Society of Engineers, Architects and Constructors.

Mr. H. S. Van Scoyoc.

Mr. A. I. Davis, a graduate in Mining of the University of Toronto, has been appointed mining engineer for the United States Gypsum Company at Fort Dodge, Iowa.

Mr. H. W. Scott has resigned as manager of the Montreal office of the Jeffrey Manufacturing Company to become associated with Mr. H. C. Freeman under the firm name of Freeman, Scott & Company, engineers and contractors, of 141 Milk Street, Boston.

Mr. N. C. Nailor, manager of the machinery department of the Canadian Fairbanks-Morse Company, has resigned to enter partnership with Mr. C. S. Rindsfoos, secretary-treasurer of the Foundation Company, of New York City, forming the United States Purchasing Company. The new company aims at effecting the economical purchase of machinery and supplies for contractors and industrial corporations.

Obituary

Mr. Cosmo Cartwright, a graduate in Mining of Queen's University, Kingston, Ont., died October 28, aged 32.

Mr. W. A. McLeod, managing director of the Stewart Machinery Company, died suddenly a few days ago at Saskatoon, Sask., where he was on a business trip.

Mr. Edwin R. Babington passed away at his home, 43 Lee Avenue, Toronto, on October 30. He was born in London, Ont., in 1848, and was a well-known architect in Toronto for over twenty years.

Mr. Donald McDermid, who constructed bridges and other similar works for the Canadian Pacific Railway in various parts of the Dominion, died recently at his residence in Toronto, aged 70 years. He was a native of Scotland.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

At Montreal, Que., damage to the extent of $20,000 was caused by a fire which broke out recently in the Glasgow Drug Hall, Notre Dame Street West.

In a fire which occurred recently at Halifax, N.S., several buildings were completely destroyed and others seriously damaged. The loss is estimated at about $125,000.

It is reported that a feldspar plant will be erected at Kingston, Ont., in the near future. Mr. C. Schnell, of Paterson, N.J., visited that city recently to select a suitable site.

The St. John, N.B., city council has voted $30,000 towards a special fund for carrying out street improvements. The main object is the relief of unemployment during the winter.

The Port Dalhousie, Ont., Board of Trade has prepared a by-law to submit to the ratepayers next January to authorize the construction of a water-works system for the town.

At London, Ont., there is a proposal on foot to construct a municipal sewage disposal plant to accommodate the east end of the city. A site for the proposed works is being obtained.

At Sarnia, Ont., a new post office and customs house has been completed for the Public Works Department. The work of construction was carried out by Mr. Geo. R. Proctor, contractor, Sarnia.

The basement of what promises to be one of the largest Roman Catholic churches in Northern Ontario is in course of construction at North Bay. When finished the church will cost about $100,000.

At Barton, Ont., Mr. J. B. Nicholson, Township Engineer, is submitting a report on estimates of the total cost of installing a sewerage system in the township at a total cost estimated at $257,863.

A committee of the Dundas Board of Trade is investigating a suggestion in favor of recommending the Town Council to employ an engineer and general overseer of the public works of the municipality.

At London, Ont., the factory of the Dominion Brass Corporation and the plant of the C. N. W. Shoe Company in the same building, were burned down recently. The total loss is estimated at about $20,000.

At Brantford, Ont., work has commenced upon a $27,000 park drive to be constructed around the city. In connection with this work the Brantford Patriotic and War Relief Association has made a grant of $6,000.

Work is beginning on the construction of a 31-room public school on North Leslie street, Toronto. The first section, which will contain twelve rooms, is to be completed by the beginning of April. The approximate cost of this section will be $60,000.

At Ottawa, Ont., the new church which is being erected for the Capuchin Fathers at an estimated cost of $156,000, is nearing completion. Messrs. Noel & Monette, Ottawa, are the general contractors. Mr. Chas. Brodeur, Hull, Que., is the architect.

At St. Thomas, Ont., the Roman Catholic community have purchased the residence and grounds of Mr. John Farrelly, overlooking Kettle Creek Valley, for the purpose of erecting an up-to-date hospital at a cost variously estimated at from $60,000 to $100,000.

The municipal council at Maisonneuve, Que., are constructing baths at an estimated cost of $150,000. At present the foundations are going in, but it is understood that actual construction will not be proceeded with this year. Mr. Marcus Dufresne is the architect.

The Provincial Hydro-electric Commission has awarded the general contract for the construction of a six-storey office building on University Avenue, Toronto, to Messrs. Witchall & Son, contractors, Toronto. The building is to be of steel, terra cotta and brick construction.

The plan which has been prepared of the location of the Galt station of the Lake Erie & Northern Railway, provides for a platform 300 ft. long, running parallel with the Grand Trunk tracks. Midway on this platform and a short distance south of Main Street, a brick station will be constructed.

At Toronto, Ont., the Board of Education is erecting a commercial high school on Shaw and Dewson streets, at an estimated cost of $260,000. The building will be 24-roomed, three-storey, and brick construction. The masonry contract is in charge of R. Robertson & Son, contractors, Toronto.

The Humber Beach hotel, which was constructed at the mouth of the Humber River, West Toronto, last spring, was totally destroyed by fire recently, the outbreak originating in the garage. The loss, which is covered by insurance, is estimated at $57,000 for the hotel and $5,000 for the garage.

The Toronto board of control has decided to devote $840,065 out of the $6,670,000 voted in 1913 for water-works extension, towards the construction of a proposed waterworks system in North Toronto. By this means the work can be carried out without submitting a by-law to the ratepayers.

The city council of Hamilton have adopted a by-law to authorize the raising of $130,000 for the construction of sewers in the east end of the city during the winter. The expenditure of $35,000 on roadway repairs was also sanctioned. Mr. A. F. Macallum, city engineer, will assume charge of the work.

Good progress is being made on the exterior work of a six-storey apartment house which is being erected on Bay Street North, Hamilton, by a [illegible] architects are Messrs. Stewart & Witton. The building is to be of reinforced concrete construction, fireproof throughout. The estimated cost is $100,000.

Through [illegible], Montreal, the De Laval Turbine Company, Trenton, N.J., have secured a contract for a 24-million gallon pump, to be installed at the Point St. Charles waterworks pumping station of the City of Montreal. This is the first pump of the size to be installed by the city. The price is $17,700.

At Hamilton, Ont., Mr. A. F. Macallum, city engineer, has notified the Board of Control that his estimate of $130,000 for the construction of sewerage works in the east end will probably be $50,000 below the actual cost. This increase over the original estimate is said to be due to extra cost of construction during the winter months.

At Fort William operations have been resumed on the new plant of the Steel Company of Canada, and a large number of men are working on the completion of the structure. The building, on which construction was started last year and deferred, owing to the dull manufacturing season, will be ready for operation towards the end of November.

The Toronto City Council has entered into an agreement with the Toronto and Hamilton Highway Commission for the construction of the Toronto-Hamilton concrete highway, at an approximate cost of $600,000. The contribution of Toronto to the scheme will be $150,000, Hamilton $30,000, and each of the other municipalities between the two cities $4,000 per mile.

The Hamilton, Ont., Builders' Exchange have approached the Board of Control with a request that a Chief Building Inspector, who would also be known as Chief Architect, be appointed for the city. The Builders' Exchange also urge the appointment of three outside inspectors and two plumbing inspectors. The suggestion is to receive the consideration of the Board of Control.

At Listowel, Ont., negotiations are in progress for the erection of a factory estimated to cost $100,000. The firm of Libby, McNeil & Libby, of Chicago, Ill., is at the head of the enterprise. Inter-switching facilities between the G. T. R. and the C. P. R. are being afforded by the Dominion Railway Board in order that the company may proceed without delay on the construction of the plant.

At Hamilton, Ont., excavations have been carried out for a $1,000,000 hotel to be constructed on King street east for the United Hotel Company (Royal Connaught Hotel). The building will be of twelve storeys, fireproof construction and will contain 250 rooms. Cut stone, terra cotta, Denison hollow tile, steel and face brick will be used. Messrs. Stone & Webster, Boston, Mass., have the general contract. Mr. A. W. Peene, Hamilton, is the architect.

From Niagara Falls comes the report of proposed boulevards on both sides of the river, running from Lakes Erie to Ontario. The Niagara Frontier Association is endeavoring to have the State build the boulevard on the American side, while the Queen Victoria Park Commission has practically [illegible] to extend the one on the Canadian side. The estimated cost of the Canadian boulevard, from Niagara Falls, Ont., to Niagara-on-the-Lake, is $450,000.

From Ottawa, Ont., comes the information that the programme of public works under construction by the Dominion Government is being carried through despite any financial stringency. To minimize unemployment all works under contract are being carried on precisely in accordance with the intimation of the Minister of Finance in his August budget statement. New works will be [illegible] the sources of revenue from which expenditure might be met become apparent.

At Montreal, Que., a syndicate is interesting itself in the erection of a theatre and apartment house in that city at an estimated outlay of $300,000. Plans are on the way to completion and tenders for the work will be called shortly. The building is to be equipped with roof garden, grill room in basement and theatre with seating capacity of 3,500. The type of construction will be reinforced concrete, terra cotta, hollow tile and steel. Mr. J. H. McDowell, Drummond Building, Montreal, is the architect.

Messrs. John Quinlan & [illegible], contractors, of Montreal, have entered an action against the Protestant School commissioners to recover nearly $200,000 in connection with their contract for the new High School on University Street, erected according to the plans of Messrs. Edward & W. S

Maxwell." The plaintiffs allege that they had to contend with much very costly foundation work in addition to the contract. The contract price was $235,000, and the contractors claim an additional sum of $183,605 and $15,000 damages.

The Architects' Association of the Province of Quebec have under consideration the question of quantity surveying, and a committee appointed to study the subject recently held a conference with members of the Montreal Builders' Exchange representing the general contractors, painters, plumbers, and electrical contractors. A majority of those present were favorable to the adoption of the system, which it was thought would prove economical and of general benefit. The exact form in which to carry out the idea has yet to be decided on, and a further meeting will be held in a short time.

The contract for the construction of the Don Section, Bloor Street Viaduct, Toronto, is still undecided. Recently the city council referred for their opinion the plans and specifications for a reinforced concrete viaduct to the Ontario Railway Board. The Railway Board in a communication to Mr. R. C. Harris, Commissioner of Works, a few days ago stated that the city was "out of court" in sending to the board for its consideration plans and specifications before the city had decided what the construction should be; that it was not within the board's duties to decide an issue between rival tenderers, but rather to approve specifications after these had been adopted by the city. The city council has now referred all the plans and specifications to Commissioner Harris for report and recommendation.

WESTERN CANADA

A refreshment and amusement pavilion, owned by the Winnipeg Electric Company, was burned down recently, with loss estimated at $30,000. Building and stock were partly insured.

The construction of the Canadian Northern line from Medicine Hat to Hanna, Alta., is advancing with rapidity. Eight to ten miles of grade have been completed and over four hundred teams are at present engaged in the work.

At Kamloops, B.C., construction work is now in full swing on a bridge over the C. N. R. to be built near Walhachin, at the first crossing of the route west of Kamloops. It is expected that the structure will be completed by the end of November.

The North Transcona grain elevator belonging to the C. P. R., which sank last fall, has been successfully restored to the vertical again. The elevator now rests on seventy concrete piers, which descend to bedrock. The storage capacity of the elevator is one million bushels.

The Provincial Government of British Columbia has been approached on the subject of the installation of a water supply system for Fort George, B.C. The proposed system will cost about $52,000, which it is the city's intention to repay to the government after incorporation has been effected.

At Vancouver, B.C., official announcement is made of a loan of $6,000,000 by the Dominion Government towards the Pacific Great Eastern Railway, now under construction from Vancouver to Fort George, B.C. The railway is guaranteed by the provincial government and the work is two-thirds completed.

The new $550,000 warehouse at Winnipeg, for the Coco Cola Company, Atlanta, Ga., is advancing rapidly towards completion, the walls having passed the fourth storey. Messrs. Jas. McDermid Company, Winnipeg, are the general contractors, and Mr. Arthur Tufts, Baltimore, Md., is the architect.

At Vancouver, B.C., a law suit has been commenced in which the firm of J. A. McIlwee & Sons, Denver, Col., sue Messrs. Foley, Welch & Stewart, contractors for the Rogers Pass tunnel, for half a million dollars. The plaintiffs had been sub-contractors for pioneer tunnel work, but their contract is said to have been annulled.

At Moose Jaw, Sask., work on the installation of a filtration system, adopted by the city council for treating water from the Snoddy Springs reservoir, will be started almost immediately. The filters will be erected at South Hill and will consist of two steel tanks, 8 ft. in diameter. The total cost of the work will be approximately $10,000.

The Saskatchewan Concrete Post Company, Limited, is to start operations in Regina, Sask., shortly. The new company has an authorized capital of $25,000 and has acquired the patent rights for Saskatchewan for steel reinforcement for concrete fence-posts and poles. Operations will be started as soon as the machinery has been installed.

At New Westminster, B.C., the city engineering department will call for tenders shortly for pile driving in connection with improvements to the penitentiary wharf at Sapperton. The proposition is to extend this wharf about 8 ft., and carry out other improvements. The work will be undertaken by the city under arrangement with the Dominion Government.

From the annual report of the Saskatchewan Highways Commission we learn that of the total sum of $1,200,000 voted by the Saskatchewan government for highways' improvements, $1,002,685 was expended on roads during the year ending April 30, 1914. Of this sum $507,517 was expended in road improvements direct and $417,066 by municipalities under commission regulations. For steel bridges and concrete abutments there was a vote of $300,000, the total sum spent on this class of construction being $337,483.

At Medicine Hat, Alta., a 3,000,000-gal. reservoir, part of the equipment of the Medicine Hat water-works, which was completed recently, is 208 feet long, 96 feet wide, 20 feet 4 inches deep, thickness of floor, 9 inches, thickness of walls—top 12 inches, bottom 24 inches. The reservoir was built entirely of reinforced concrete without any waterproofing compounds, "Canada" Portland cement exclusively being used. The composition of concrete was one part cement, two parts sand and four parts concrete. The contractors for the work were The Canada Cement Company, Montreal.

At Vancouver, B.C., Mr. Geo. J. Bury, vice-president of the C. P. R., has announced that practically half the main line between Fort William and Vancouver had now been double-tracked, approximately 350 miles of double-tracking having been completed this year between Brandon and the Pacific Coast. Several heavy double-track steel bridges are being constructed, grade reductions made and a five-mile tunnel bored through a mountain, 10,000 feet high, in the Rogers Pass. Mr. Bury also stated that the Kootenay Central Railway would be completed before the end of the year.

Book Reviews

Steel Construction. By H. J. Burt. Published by the American Technical Society, Chicago. Four hundred pages, 236 illustrations; flexible leather, pocket size; price $2.75. As a reference book for architects, contractors, civil engineers and designers this work cannot fail to be found extremely valuable. It is intended to provide the facts and formulas needed in designing the steel frame-work for buildings. The principles are explained carefully in order to enable the student to determine the proper limitations of the tables and formulas. The illustrations will be found particularly useful as an aid to solving the problems usually encountered in practice. A unique feature of the book is a complete set of drawings and details in connection with the design of a 16-storey hotel. The author of the book is Structural Engineer for the well-known architectural firm of Messrs. Holabird & Roche, Chicago.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
The carrying out of road improvements to Dundas Street, from Summerville to Cooksville, at an estimated outlay of $5,000, is in contemplation by the Town Council. Mr. Wheelock is the engineer. Mr. W. H. McFadden is the town clerk.

Barton Twp., Ont.
The City Council of Hamilton has approved of the scheme to allow the Township to drain into the James Street sewer until such time as the township's sewerage scheme as planned shall have been carried out.

Belmont, Ont.
A by-law will be submitted to the ratepayers on November 25 for a mandate to lay gas mains in the village of Belmont for the municipality of Westminster. Mr. Geo. Riddell, Wilton Grove P. O., is the clerk.

Halifax, N.S.
Tenders will be received until November 26 by Mr. E. H. Armstrong, Halifax, Commissioner Provincial Government Department Public Works, for the construction of 80 culverts on road from Windsor to Walton, approximately 35.7 miles. Plans and specifications are at office of Maynard ,Miller, Brooklyn; Captain Dexter, Cheverier; Rout Gass, Shubenacadie and J. P. Graham, Windsor.

Hamilton, Ont.
The National Gas Company, Limited, 501 Bank of Hamilton Building, require tenders for trenching and laying at once. Pipe line for natural gas extending from Blackheath 'to Hamilton, a distance of about sixteen miles. Also about 7½ miles in Hamilton. Plans are with the manager, Mr. R. F. Miller. Work is to be done at once.

London, Ont.
The City Council has recommended letting the following contracts in connection with sewerage construction: Fielder [illegible] Street, $667; City Engineer's Department, Orchard [illegible] $438.40. Work is to be proceeded with at once. Mr. Wm. N. Ashplant is City Engineer.

Leamington, Ont.
Tenders close on November 10th with the Town Council (Mr. R. M Selkirk, Clerk), for 10,718 feet of 20 inch to 48 inch tiling and 6,500 feet of open drainage work, including bridge. Covered portion to be for either glazed sewer tile or cement work or corrugated pipe. Plans are at the office of the Town Clerk

Ottawa, Ont.
The City Council has passed a by law to expend about [illegible] construction of an intake pipe. Work is to be proceeded with at once.

The Board of Control are open to receive tenders until 4 p.m., November 26th, for supply and delivery of direct-connected, electrically-driven low-lift turbine pump and motor for Queen Street Pumping Station. Plans and specifications are at office of Waterworks Engineer, Mr. R. L. Haycock. Specifications may be seen at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Redcliff, Alta.
A by-law has been approved authorizing the construction of sidewalks at a total estimated cost of $26,000 for the City Council. Cement sidewalks costing $18,000 will be laid and wooden sidewalks involving the expenditure of $8,000 will be laid as soon as debentures are sold. Mr. A. J. Nicholson is the city clerk and Mr. J. E. Askwith is engineer.

St. Catharines, Ont.
Negotiations have been completed by the Dominion Government Department of Railways and Canals for the construction of a water pipe line to supply St. Catharines, Welland, Merritton and Thorold direct from Lake Erie, Estimated cost $1,000,000. The municipalities will contribute one-half the cost. Tenders will be called and work started shortly. Hon. F. Cochrane, Ottawa, is Minister of Railways and Canals.

Toronto, Ont.
The Board of Control has under contemplation the laying of asphalt pavements on Terauley Street, from Agnes to Gerrard Street; at an estimated cost of $26,970. Also asphalt surface on Gloucester Street, estimated to cost $2,837.

Tenders close November 24th with the Board of Control for a supply of 72-inch valves for water pipes. Plans, etc., are at [illegible] City Hall, [illegible] Department.

The Board of Control will receive tenders until [illegible] supply and laying of a 72-inch steel conduit from the [illegible] Toronto Island to the 72 inch and 84-inch steel conduit, a distance of about [illegible] Mr. [illegible] Milne, Room 6, City Hall, is Mechanical Engineer.

Vancouver, B.C.
The City Council has [illegible] at an estimated cost of [illegible] Operations are to be commenced in the near future. Mr. M. R. Bennett is engineer

Winnipeg, Man.
The construction of board granolithic [illegible] Avenue, from Tecumseh to McPhillips, is being undertaken by the Board of Control, who have called for [illegible]

Mr. J. W. Astley is Engineer of Construction. Estimated cost $1,256.29.

CONTRACTS AWARDED

Ojibway, Ont.
The contract for street grading at an estimated cost of $20,000, 3¼ miles long, 100 feet wide, to be laid near Windsor, has been awarded to Mr. John Dewhirst, Woodslee or Windsor. The United States Steel Corporation, New York City, are the owners. Local representative, Mr. O. E. Fleming, Windsor.

Toronto, Ont.
The contract to construct a sewer on Kenwood Avenue, 1,635 feet long, has been awarded to the Grant Contracting Company, Toronto, by York Township Council. Mr. Frank Barber, 57 Adelaide Street East, is the engineer.

Winnipeg, Man.
The contract for the construction of No. 1 asphalt pavement on Lane north of Portage Avenue, between Smith and Donald Streets, has been awarded by the Board of Control, to Mr. J. W. Astley, Engineer of Construction, at an estimated cost of $1,552.50. Mr. Astley has also been awarded the contract for asphalt pavement at $1,110.

The contract to supply 100 6-in., 5 10-in. and 5 14-in. valves for Domestic Waterworks at $1,867, has been let by the Board of Control to Drummond, McCall & Company, 334 Somerset Building.

The contract for plumbing and sewer connections for private properties, has been let by the Board of Control to Bower & Robinson, 187 Maryland St at $747.25.

Railroads, Bridges and Wharves

Edmonton, Alta.
The Edmonton, Donvegan & B. C. Railway Company have had plans drawn for the construction of a railway terminal near St. Albert's Trail. It is the intention of the company to erect an engine room to cost approximately $10,000. Work will be proceeded with at once. The company are the general contractors.

Euphemia Twp., Ont.
The Twp. Council has passed a by-law to authorize the reconstruction of a bridge over the [illegible] and Dawn Twps. drain. Mr. D. M. Smith, Cairo is the clerk.

Prince Rupert, B. C.
Plans have been drawn by Mr. B. B. Kelliher, chief engineer, G. T. P. Railway, Union Station, Winnipeg, for the construction of a terminal, the contract for which will be awarded shortly.

CONTRACTS AWARDED

Endako, B.C.
The G. T. P. Railway has awarded the contract to [illegible]

[illegible] Bank Building, Winnipeg, for the construction of a railway terminal. The work is to be done during the present year. Mr. B. B. Kelliher, Union Station, Winnipeg, is the [illegible]

Pacific, B. C.
The contract to construct a railway terminal has been let by the G. T. P. Railway Company to Carter Halls-Aldinger Company, Winnipeg. Work is [illegible] be carried through this year.

Smithers, B. C.
Work is to be started at once on the construction of a railway terminal here. The general contract for the work has been awarded by the G. T. P. Railway Company to Carter-Halls-Aldinger Co., Winnipeg.

Business Buildings and Industrial Plants

Arden, Ont.
Buildings occupied by the Bell Telephone Company, Royal Bank of Canada, Post Office, General and Hardware Stores and Implement Warehouse, have been destroyed by fire. The property was partially insured.

Cookshire, Que.
A skating rink, 75 x 125, dressing room, etc., will be erected by Mr. F. C. Hurd and Mr. G. B. Porter. The site for the building has not yet been selected.

Deer River, Ont.
The Trenton Cooperage Mills, Limited, Spragg Street, Trenton, are contemplating the rebuilding of their plant next spring. Estimated cost $12,000.

Edmonton, Alta.
The general contractors, Turner Bros. & Clindining, 51 McAuley Street, will sub-let plastering work on a $39,000 school, two storeys, 88 x 74, brick and steel construction, for the Separate School Board. Painting, heating, plumbing and electrical work have not yet been let. Mr. A. J. McCormack, 16 Bradburn Thomas Block, is the architect.

Work has discontinued temporarily on the construction of $25,000 hotel on Queens for Mr. W. H. Connor, Imperial Hotel. It is understood the building will not be completed this year.

The Alberta & Great Waterways Railway Company, care Mr. J. D. McArthur, St. Albert's Trail, general contractor, have had plans drawn for the construction of engine shed and machine shop, estimated to cost $10,000. Operations will be started immediately.

Hartland, N.B.
A potato warehouse, the property of Halfield & Scott, has been burned down. Loss to building is estimated at $5,000.

Halifax, N.S.
A loss, estimated at $35,000, has been sustained by Mr. Roy, Room 10, Roy Building, Barrington Street, in the destruction by fire of two stores, one frame and the other brick construction. Owner will rebuild.

Mr. Frank Reardon, 25 Saymour St., has decided to rebuild factory which was burned down recently, involving a loss estimated at $40,000.

London, Ont.
The Board of Education has instructed Committee No. 2 to make arrangements for the purchase of furniture for the Boyd Memorial School. Mr. R. N. McElheran is Secretary of the Board of Education.

Montreal, Que.
The sub-contract for stone trimming in connection with addition to bakery on 246 City Hall Avenue, at an estimated cost of $100,000, for Mr. James Strachan, has been awarded to Wallace Sandstone Quarries, Limited, Room 505, Transportation Building. Messrs. P. Lyall & Sons Construction Company, Limited, Montreal, are the general contractors.

In connection with a $3,000 store in course of construction on 50 Fort for Mr. W. B. Gilmore, 866 St. Catherines Street West, owner is receiving tenders on brick, carpentering, painting and glazing. Store will be three storeys, 41 x 25.

The contemplated warehouse for the C. P. R. on Craig Street, estimated to cost about $200,000, has been cancelled.

The sub-contract for electrical work in connection with alterations to store, at an estimated cost of $3,000, for Mr. P. Wright, Notre Dame and Bisson Streets, will be let shortly by the architect, Mr. W. E. Doran, 189 Bleury Street. Mr. James McNeil has the general contract.

The Canadian Steel Products Company's warehouse, 227 Wellington St., has been damaged by fire. Extent of loss is not reported.

A permit has been granted to Mr. A. Laframboise, 239 Rockland Street, to carry out alterations to bakery.

Oakville, Ont.
The Town Council is considering the question of erecting a fire hall at an estimated cost of $10,000. Mr. W. E. Crawley is the Town Clerk.

Ottawa, Ont.
Prices are being taken on roofing, plastering, painting, heating and plumbing, in connection with the construction of a steel, reinforced-concrete and brick factory building on Sparks Street, at an estimated cost of $15,000, for Mr. Robt. Brown, 367 Sparks Street. Mr. R. James, 70 Fairmount, is the architect. Messrs. James & Ramsay, 70 Fairmount, have the general contract.

Plans are in progress for the construction of two $9,000 stores on Bank Street, for the Oakland Land Company, in care of C. C. Ray Company, Limited, Sparks Street. Stores will be brick veneer construction, concrete and stone foundation. Mr. J. M. Hurcomb is secretary-treasurer.

Regina, Sask.
The warehouse of Stamco Bedding Company, St. John and Eighth Avenue, has been destroyed by fire. Loss $5,000 to $6,000.

Sarnia, Ont.
A loss of $10,000 has been sustained through the destruction by fire of hotel at St. Clair Flats, owned by Mrs. Ella Sanderson.

St. Catharines, Ont.
Tenders are at present being received for construction of barn for Mr. Wm. Bowman at an estimated cost of $3,500.

Barn and equipment owned by Port Weller Security Company, 415½ Yonge Street, Toronto, has been destroyed by fire. Loss $5,000, a small proportion of which was covered by insurance.

The Grand Trunk Railway Company has in contemplation the erection of a station here. The site is being selected. Mr. J. Boyd, Hamilton, Ont., is Divisional Superintendent.

Tilsonburg, Ont.
Plans are drawn and work is to start in a few days upon the construction of a garage on Broadway at an estimated cost of $2,500 for Mr. H. G. McComber, owner and general contractor. Mr. W. Drake is doing the mason work.

Toronto, Ont.
Tenders close November 13th with the Board of Education (Mr. W. C. Wilkinson, Secretary-Treasurer), for all trades in connection with the enlargement of North Toronto High School. Construction is to be steel, concrete and brick, and the new building will contain eight rooms and assembly room.

Mr. W. C. Wilkinson, Secretary-Treasurer of the Board of Education, is open to receive tenders until November 13th, for all trades in connection with the construction of a twelve-room school building, steel, concrete and brick construction, on Colbeck and Runnymede.

Tenders are invited on plastering, heating, plumbing, roofing and wiring store and residence, 3-storey, brick construction, being erected on 271 Dundas Street, for Milne & Milne, 1093 Dovercourt Road. Plans dealing with the work may be seen at 271 Dundas Street.

Tenders for plastering store and residence on College Street and Manning Avenue, at an estimated cost of $10,000, for Modern Ladies Tailoring Company, 780 College Street, are invited. Building will be three storeys, 24 x 56, brick construction.

Sub-tenders are open for tar and gravel roofing, eave-troughing and electric wiring of $6,000 garage, two storeys, 120 x 43, brick construction, for Mr. F. C. Hall, 142 Harrison Street. Mr. W. S. Grimshaw, 895 College Street, is the general contractor.

Windsor. Ont.
Reaume & Tassie, Ford City, Ont., will let the contract shortly for the construction of a two-storey, 35 x 115, artificial stone and brick theatre at Windsor. The estimated cost is $12,000. G. Jacques & Company, Boug Building, are the architects.

The construction of a factory building for the manufacture of tile and concrete products is contemplated by Mr. W. T. Atkinson, of Amherstburg, Ont.

Plans are in progress for the construction of a $4,500 warehouse on Mercer for Mr. David Meretsky. The building will be two storeys, 105 x 22, reinforced concrete and brick construction. It is reported that work will be done by day labor. G. Jacques & Company, Boug Building, are the architects.

CONTRACTS AWARDED

Edmonton, Alta.
Alberta & Great Waterways Railway Company has awarded the contract for

construction of depot and freight sheds near St. Albert's Trail to Mr. J. D. McArthur, St. Albert's Trail. Estimated cost $5,000.

London, Ont.

The following contracts have been awarded in connection with alterations to stores and apartments on 340 Richmond Street, for Harry Ryan at an estimated outlay of $3,000:—Carpentry, Mr. Phillipino; tiling floors, Spence Bros.; iron work, Dennis Wire & Iron Works, Limited; plastering, Scott & Sons; heating, Stavely & Company; plumbing, Mr. Wm. Kelly; interior fittings, Mr. Ingram. Construction work will include apartments, store fronts, barber shop and restaurant in basement. Messrs. Watt & Blackwell, Bank of Toronto Chambers, are the architects.

Montreal, Que.

The sub-contract for foundations of the Royal Connaught Hotel, Hamilton, Ont., has been awarded to the Raymond Concrete Pile Company, Limited, New Birks Building, Montreal. Messrs. Stone & Webster Construction Company are the general contractors.

Ottawa, Ont.

The contract for the construction of a garage on Linden Terrace for Mr. E. M. Terner, has been awarded to Mr. A. Bochmar, 280 Creighton Street, Ottawa. Garage will be stucco construction, concrete foundation.

Public Buildings, Churches and Schools

Bathurst Village, N.B.

A quantity of seating will be purchased for the new College which has been erected for the Eudist Fathers (Father P. LeBastard), at a cost of about $90,000.

Clinton, Ont.

Plans are in progress for alterations to library for the Town Council, estimated to cost $5,600. Tenders for the work have not yet been called. Mr. J. A. Fowler, Goderich, is the architect. Mr. D. L. MacPherson is the Town Clerk.

Montreal, Que.

The contract for tiling will be let shortly by the architects, Messrs. Hogle & Davis, 80 St. Francois Xavier Street, or the general contractors, the Atlas Construction Company, in connection with 8-storey, steel, terra cotta and brick bank and office building on McGill and James Streets, [illegible]

The architects, Messrs. Hogle & Davis, 80 St. Francois Xavier Street, will invite tenders in a few days for interior fittings in connection with erection of bank on [illegible] Merchants Bank [illegible] Street.

New Westminster, B.C.

Tenders will be invited shortly for some trades in connection with alterations and additions to court house here, at an estimated outlay of $56,000, for Provincial Government Department Public Works. Building will be three storeys and basement, 98 x 45, brick construction, stone trim. Gardner & Mercer, Western Trust [illegible] chitects. Mr. J. E. Griffith is the engineer. Dominion Construction Company, Northwest Trust Building, Vancouver, have the general contract.

Ottawa, Ont.

Tenders will be called in the near future for carpentry, roofing, plastering and painting in connection with the construction of $75,000 bank on Sparks St., for the Royal Bank of Canada. The building is to be 90 x 75, terra cotta construction. Mr. K. G. Rae, Guarantee Building, is the architect. Purdy & Henderson, New Birks Building, Montreal, are the general contractors.

Queenston, Ont.

The contract for electrical work is to be let in connection with the construction of $18,000 school building for School Section No. 14. R. Smith & Sons, River Road, Niagara Falls, Ont., are the general contractors. Mr. A. E. Nicholson, 46 Queen Street, St. Catharines, Ont., is the architect.

St. Laurent, Que. (Montreal)

A Home is to be erected here for the Deaf and Dumb Institution. The architects, Gauthier & Daoust, 180 St. James Street, will be ready to receive tenders about January 15th.

Toronto, Ont.

The City Council, Architect's Department, has issued a permit to the Board of Education to erect a three-storey brick school building on Euclid Avenue at an estimated cost of about $55,000. The City Architect's Department has approved of the plans.

Wheatley, Ont.

The Methodist Church Congregation will be purchasing seating for new $15,000 church. Mr. J. W. Kennedy is Secretary, building committee.

Residences

Lachine, Que. (Montreal)

Plans have been drawn for the construction at Dominion Park of three residences at an estimated cost of $10,000, to be erected by Mr. J. B. Lanauette, 1170 St. James Street, Montreal. The architects, Messrs. MacDuff & Lemieux, 320 St. Catharine Street West, will award the general contract shortly.

Montreal, Que.

Tenders on tiling are still being taken by the general contractors, A. F. Byers & Company, 340 University Street, in connection with the construction of two residences, 2½ storey, 50 x 36, stone and brick construction, for Mr. R. E. Powell, [illegible]

Ottawa, Ont.

The construction of a $4,000 residence on Grove Street is contemplated by Mr. V. V. Rogers, 192½ Sparks Street. Building will be brick veneer construction, [illegible]

[illegible]

[illegible] on Grove Street, 2½-storey, 28 x 28, is [illegible] Sparks Street, owners and architects.

[illegible] of residences, stables, etc., at City View, at an estimated outlay of $12,000, for Mr. J. Gorman, Minto Hotel. Buildings will be stucco construction. Work may be done by day labor. Mr. Frank Sullivan, Castle Building, Queen Street, is the architect.

Tenders will be received by Mr. Wm. Spratt, Sunnyside Avenue, general manager of the Oakland Land Company, in care of C. C. Ray Company, Limited, Sparks Street, for all trades except masonry, in connection with the construction of 2½-storey, 25 x 28, brick veneer residence, at an estimated cost of $6,000. Mr. J. H. Hurcomb, 1111 Bank Street, is the secretary.

Oakville, Ont.

In connection with the erection of a $5,000 residence on Douglas Avenue, the owner, Mr. A. F. Ford, will do the work by day labor. Doors, sash, flooring, hardware, glass, etc., will be purchased by him. Building will be 32 x 34, constructed of Indiana trim stone and pressed brick.

Quebec, Que.

The sub-contract for painting $5,000 residence on Cartier and Cremazie Sts., for Mr. John Demers, 113 Fourth St., Limoilou, has not yet been let. Residence will be three-storey, 30 x 40, frame and brick construction.

The sub-contract for painting in connection with the construction of a residence on Cartier Avenue for Mr. A. Frederick, 480 St. John Street, at an estimated cost of $6,000, will probably be let shortly. The building is brick construction.

St. Catharines, Ont.

A permit has been issued to Mr. G. Warren, 139 Church Street, to erect a residence on Centre and Court Streets, 2-storey, brick construction, estimated to cost $4,200.

St. Lambert, Que. (Montreal)

In connection with a $9,000 residence in course of construction on Argyle Avenue for Mr. J. H. Randville, 97 St. James Street, Montreal, the contractor, Mr. A. Gravel, is receiving tenders on roofing, painting and electrical work.

Toronto, Ont.

Mr. F. J. Male, 317 Sunnyside Avenue, will sublet contracts for plastering, painting, heating, plumbing and electrical work on one pair of $3,500 residences, two-storey, 23 x 42, brick construction, on 143 Macauley Avenue.

The construction of a 2½-storey brick [illegible] is contemplated by Mr. W. B. Charlton, 412 Indian Road.

In connection with the construction [illegible] and Mountjoy Streets, the owners, Messrs. Campbell & Campbell, 34 Vic[illegible] contract.

[illegible] The cost is estimated at $2,820. Alderman H. A. Rowland is chairman.

Victoria, B. C.

[illegible] W. Patterson, Lieut.-Governor, Government House, the general contractor, P

Tenders and For Sale Department

Notice to Contractors

Sealed tenders, addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control up to **4 p.m. Thursday, November 26th, 1914**, for the supply and delivery of a direct connected, electrically-driven, Low Lift Turbine Pump and Motor.

Any tender received after the above-mentioned time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

Specifications and full information may be obtained at the City Engineer's Office.

(Sgd.) R. L. HAYCOCK,
Acting W. W. & S. Engineer.
City Hall, Ottawa,
November 5th, 1914. 45

Notice to Contractors

Sealed tenders, addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control up to **4 p.m. Thursday, November 26th, 1914**, for the supply and delivery of a direct connected, electrically-driven, High Lift Turbine Pump and Motor.

Any tender received after the above-mentioned time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

Specifications and full information may be obtained at the City Engineer's Office.

(Sgd.) R. L. HAYCOCK,
Acting W. W. & S. Engineer.
City Hall, Ottawa,
November 5th, 1914. 45

Tenders for 72-inch Steel Conduit

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on

Tuesday, November 24th, 1914

for the supplying and laying of a 72-inch steel conduit from the Mechanical Filtration Plant to the 72-inch and 84-inch steel conduits on Toronto Island.

Drawings, specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer, Department of Works, Room 16, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control,
City Hall, Toronto, 2nd November, 1914. 45

Tenders for Fire Alarm System

Sealed tenders for the installation of a Fire Alarm System for the Town of Galt, Ontario, will be received up till **Monday** at **noon** of **November 16th**, addressed to the undersigned.

Parties tendering to submit specifications for a town of 12,000, with an area of approximately 1,600 acres.

The Corporation does not bind itself to accept the lowest or any tender.

JOSEPH M'CARTNEY,
45 Town Clerk.

Tenders for the Construction of a Bridge on the Rosedale Section of the Bloor Street Viaduct

Tenders will be received, by registered post only, addressed to the chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Monday, December 21st, 1914**, for constructing across the Rosedale Valley a bridge 86 feet wide, consisting of one steel arch span with piers and approaches, the length being, approximately, five hundred and eighty feet; and a retaining wall, approximately one hundred and seventy feet long, extending westward from the bridge. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's estimate of quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England; The Engineering News, New York; Engineering and Contracting, Chicago, and Engineering, London, England.

Those desiring to submit tenders on reinforced concrete construction for the above bridge are hereby notified that they may prepare and submit, without any expense whatsoever to the city, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on **Monday, December 21st, 1914.**

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by city by-laws, must be strictly complied with, or tenders may be declared informal.

A deposit in cash or a marked cheque, equivalent to 2½ per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender, which deposit will be retained until provisions of by-law 4294 are complied with.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
City Hall, Toronto, November 9th, 1914. 45

Drainage Tender

Tenders are called for Drainage Work of **10,718** feet of 20-in. to 48-in. Tiling, and 6,500 feet of Open Drainage Work (including Bridge). Along covered portion, which lays mostly through town lots, a connection to be left for each lot. Tender for Covered Portion to be for either Glazed Sewer Tile, or Cement Crock, or Corrugated Pipe. Tenders opened **evening November 16th.** Plans and Specifications at the Clerk's Office, Leamington.

Dated, Leamington, November 4th, 1914.

R. M. SELKIRK,
45 Clerk, Leamington, Ont.

CITY OF ST. CATHARINES

Tenders for Superstructure of Steel Viaduct

Tenders will be received up to **December 8th, 1914**, for the construction of a steel viaduct, known as the St. Paul St. High Level Bridge, 1,236 feet long, 41 feet wide, and 89 feet above the water level of the Old Welland Canal. Approximate quantity of steel is 2,614,000 lbs.

Plans and specifications and other information will be available at the office of the City Engineer on and after November 17th. A deposit of Ten Dollars will be required for Plans, which deposit will be returned on receipt of a bona fide Tender.

W. P. NEAR,
45 City Engineer.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 24th**, for the construction of the following sewers, viz.:

Alton Avenue Drainage System Outlet, from 71 feet north Stanton Avenue to Ivy Avenue, via lane at north end of Alton Avenue, lot No. 46 Gerrard Street, part Township lot No. 10, Hastings Avenue, Hariett Street, and lane first east Leslie Street to Ivy Avenue.

Barwick Avenue, Lawlor Avenue to Cockburn Avenue; Bingham Avenue, Bracken Avenue to Gerrard Street; Eastern Avenue, Knox Avenue to Morley Avenue; Evans Avenue, Colbeck Street to Annette Street; Howell Street, Kennedy Avenue to Runnymede Road; Kingswood Avenue, Lyall Avenue to Gerrard Street; Scarboro Road, Kingston Road to Gerrard Street, Swanwick Avenue, Cockburn Avenue to Victoria Park Avenue; Victoria Park Avenue, Bracken Avenue to Gerrard Street; Wheeler Avenue, 1,720 feet north of north side, Queen Street to north end; Medland Crescent, Oakmount Road to Hillsview Avenue.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties approved by the City Treasurer in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid. The usual condtions relating to tendering as prescribed by City By-law must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
Toronto, November 4th, 1914. 45

TOWN OF THOROLD
PROVINCE OF ONTARIO

Sealed tenders will be received by the Chairman [illegible]

8 P.M. Wednesday, November 25th, 1914

For a Complete

Water Filtration Plant

General plans are open for inspection at Thorold or at the Toronto Office of the Engineers.
Board Water Commissioners.

JAMES WILSON, Esq., Chairman,
JOSEPH BATTLE, Esq., Mayor,
FRANK H. KEEFER, Esq.
CHIPMAN & POWER, Engineers,
Mail Building, Toronto.

November 10th, 1914 [illegible]

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, November 13th, 1914

for all trades

Enlargement of North Toronto High School

New Building, Corner of Colbeck Avenue and Runnymede Road

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted Bank [illegible] or its equivalent in cash. Tenders must be in [illegible] received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
[illegible]

J. W. JACKSON,
[illegible]

45

Mechanical Draughtsman

[illegible] neat letter and steady worker. Not at all of work. Reasonable salary. Best of references. [illegible]

Sales Engineers Wanted

[illegible]

Sales Engineers Wanted

[illegible]

CAPITAL introduced for sound enterprises of all kinds. 5 per cent. commission. Bond and stock issues placed. Underwriting procured. References exchanged. Address Cooke & Byrne, Harcourt Street, Dublin, Ireland. 40-45

Representatives Wanted

U. S. Paint and Varnish Manufacturers want representatives who are well acquainted with leading Architects and Contractors, in each Canadian province. Exclusive Provincial agencies will be given to right parties. Box 104, Contract Record, Toronto.

Sales Agents Wanted

Firm making "U" Support Ties and Bar Supports for Concrete Work wants sales agents throughout Canada. Apply Box 98, Contract Record & Engineering Review, Toronto. 45-47

Agents Wanted

We are open to appoint Provincial agents for our frost proof water meters. Adopted by leading towns and cities in Northern States. Apply Box 103, Contract Record & Engineering Review, [illegible] 45-47

Agents Wanted

Canadian firms having good municipal connections can make money selling a new improved sewer cleaning machine which already has a big sale in the U. S. A. Write stating the territory you can cover. Box 97, Contract Record & Engineering Review, Toronto. 44-46

Agents Wanted

Large firm making low voltage transformers and electrical measuring instruments wants sales [illegible] sign lighting, bell ringing, and toy requirements. The electrical measuring instruments include a complete line of switchboard and portable Ammeters and Voltmeters. All agents to work on a commission basis. Write stating what territory you can handle. Box 93, Contract Record, Toronto. 43-45

Residences

(Continued from page 61)

McKenzie, 2358 Cadboro Bay Road, will sub-let contract for painting. Residence will be 12-roomed, frame construction.

Plans are prepared for the construction of a $10,000 apartment house at Ross Bay for Mr. Ernest Lloyd, care architects, Rochfort & Sankey, 505 Union Bank Building, owner and general contractor. All material, including 18 suites, will be purchased by the owner.

Westmount, Que. (Montreal)
The construction of a $15,000 residence on Avenue Road for Mr. E. N. Robertson, 117 Notre Dame Street West, will not be carried out for the present.

[illegible] by fire. The loss is estimated at $4,000.

CONTRACTS AWARDED

Ottawa, Ont.
[illegible] for Mr. D. Fraser, O'Connor Street, has been awarded to Mr. Robert J. Watson, [illegible]

Quebec, Que.
The sub-contract for painting $20,000 [illegible] three-storey, 60 x 30, brick and stone construction. Mr. J. B. Verret, Limoilou, is the general contractor.

Power Plants, Electricity and Telephones

Edmonton, Alta.
The Edmonton, Dunvegan & B. C. Railway Company have had plans drawn for the construction of Power Houses at St. Albert's Trail, at an estimated cost of $8,000. Work to start at once.

Newmarket, Ont. (Toronto)
The Town Council has requested the Provincial Hydro-electric Commission to furnish estimates for a power supply for street lighting and domestic use. Mr. J. E. Hughes is town clerk.

Ottawa, Ont.
The City Council has in contemplation the carrying out of repairs and alterations to Aberdeen Building, Lansdowne Park, at a cost estimated at $20,000. Alterations will include new concrete foundation, bricking of structure, new roof, galvanized iron cornices, painting and sanding. Mr. Norman H. H. Lett is the secretary.

Tenders are to be called immediately for supplying and installing elevators in the Isolated Hospital of which the City Council is owner. Dr. Parent is chairman of the Board of Health.

The Canadian Fire Underwriters' Association have requested the City Council to purchase three additional fire engines. The Council has definitely taken the matter in hand.

Tillsonburg, Ont.
The electrical plant owned by Barkey Bros. has been destroyed by fire. The loss is estimated at $10,000.

Toronto, Ont.
The Works Committee have approved of the recommendation of Street Commissioner Wilson in favor of establishing an incinerator plant on Toronto Island at an estimated cost of $15,000.

Tenders close November 26 with Toronto Hydro-electric Commission, 226 [illegible] transformers and switchboard panels. [illegible] Purchasing Agent.

The Board of Control has decided to build a new car barn and purchase a quantity of rolling stock for new Civic [illegible] law authorizing the work has not yet been passed by the City Council.

Winnipeg, Man.
The Waterous Engine Works Company, Limited, Winnipeg, have been awarded the contract by the Board of Control for supply of boiler for steam engine at $1,510. This contract is said to have been awarded previously to Doty [illegible]

CONTRACTS AWARDED

London, Ont.
[illegible] tract to supply three electric locomotives [illegible]

way Company, at a cost of about $130,000. The engines are to be 1,000 h.p. and the cars 600 h.p. Mr. Spittal is the engineer.

Montreal, Que.

The contract in connection with church building for Mr. Fabrique, St. Elizabeth, has been awarded to Messrs. Lefebvre & Provost, Montreal. Messrs. MacDuff & Lemieux, 320 St. Catherine Street W., are the architects.

Ottawa, Ont.

The contract for interior equipment [illegible] McAuliffe Davis Lumber Company, Chamberlain Avenue, consisting of electrical apparatus and motors, has been awarded to Costello & Crowe, 380 Bank Street.

Miscellaneous

Galt, Ont.

The Town Council is open to receive tenders until November 16 for the supply of a fire alarm system. Specifications to be submitted for a town of 12,000 population, area of 1,600 acres. Mr. Jos. McCartney is the town clerk.

Halifax, N.S.

Tenders addressed to Mr. A. Johnston, Deputy Minister of Marine and Fisheries, Ottawa, will be received up to noon, December 1, for the construction of two wooden lighthouse towers to be used as range lights, at Sheet Harbour, Halifax. Plans and specifications are at Department of Marine & Fisheries, Ottawa, also at agency of department, Halifax.

Montreal Que.

The Dominion Government Department of Militia & Defence, High School, 197 Peel Street, will purchase at once 35 to 40 hand chemical fire extinguishers of approved type, capacity 2½ gals., for use in High School, Peel Street.

Ottawa, Ont.

The City Council is contemplating the remodelling of entrance to Lansdowne Park at Bank Street, at an estimated cost of $3,500. Improvements will include new concrete foundation, bricking of structure, new roof and new turnstiles. Mr. Norman H. H. Lett is the secretary.

St. John, N.B.

Tenders will be received until 4 p.m., November 23rd, by Mr. R. C. Desrochers, Secretary, Dominion Government Department Public Works, Ottawa, for the construction of fittings, including cupboards, shelving, harness racks, counters, rifle racks, etc., at drill hall. Plans and specifications are at office of D. H. Waterbury, clerk of works, St. John, and Department, Ottawa. Specification at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

St. Marys, Ont.

St. Marys Wood Specialty Company, Limited, are reported to be desirous of purchasing the following machinery: Fisher or similar re-saw; Ober axe handle lathe, Ober rod machine.

CONTRACTS AWARDED

St. Joseph de Beauce, Que.

The Presbytery of St. Joseph de Beauce has awarded the masonry contract for the construction of foundation and pedestal, of Stanstead granite, to Arsene Gosselin, Beauceville.

Toronto, Ont.

The contract to supply 25 fire alarm boxes and other apparatus has been awarded by the Board of Control to the Northern Electric Company, Simcoe St., at $3,391.

Winnipeg, Man.

The Board of Control has let the general contract for the supply of 150,000 ft. b.m. lumber, 3 ins. and over, at $22.37 per 1,000 ft., to McDonald-Dure Lumber Company, Limited, Winnipeg. Mr. W. P. Brereton, 223 James Avenue, is the engineer.

Business Notes

A firm of wholesale builders' ironmongers in the south of England makes enquiry for names of Canadian makers of wire and wire nails. Particulars regarding this firm may be obtained by communicating with the secretary, Department of Trade and Commerce, Ottawa.

New Companies

The Associated Cement Company (Canada) Limited, has been incorporated with a capital of $2,000,000 for the manufacture and sale of Portland cement and subsidiary building material. The head office of the company will be at Victoria, B.C. The incorporators include James Steller Lovell, Accountant, and Wm. Bain, Bookkeeper, both of Toronto.

Metals Limited has been licenced to carry on business within the province of British Columbia. The operations of the company include the business of electricians, mechanical engineers and manufacturers and dealers in electricity, gas, motor cars, etc. The capital of the company is $250,000 and the head office in British Columbia is at 566 Beatty Street, Vancouver, B.C.

Mannesmann Tube Company, Limited, has been licenced in British Columbia with head office at 121 Pemberton Building, Victoria, B.C., to manufacture and deal in all kinds of steel and iron tubes and fittings.

The Canadian Underwriters Electrical Inspection Bureau, Limited, has been incorporated with head office at Montreal and a capital of $25,000. The company will manufacture and deal in electrical apparatus, etc. Mr. Alf. W. Hadrill, 20 St. Nicholas Street, is said to be interested.

J. B. Turney & Company, Limited, has been licensed to operate in British Columbia, with head office at the Imperial Bank Block, Fernie, B.C. The company will engage in the production of sand, lime and clay and the manufacture of cement and by-products of cement, artificial stone, drain pipes, tiles, bricks and builders' material generally.

Late News Items

Edmonton, Alta.

It is reported that the City Council has returned tenders for conduit construction work, and that new tenders will be called next spring.

Gatineau Point, Que. (Hull)

Mr. Tremblay and Mr. Bouchard will probably rebuild stables, etc., which were destroyed by fire recently.

Hamilton, Ont.

Tenders for separate trades will be let as required in connection with 2½-storey $8,000 brick residence on Main Street East, for Mr. Geo. A. Truman, Driving Park Hotel. Mr. C. G. Hudson, Driving Park Hotel, is the general contractor.

Kingston Mills, Ont.

Kingston Council has not yet accepted the offer of Mr. J. M. Campbell to supply city with 500 h.p. in connection with new power station.

Lac La Biche, Alta.

Alberta and Great Waterway Railway, care J. D. McArthur, St. Albert Trail, Edmonton, are contemplating the construction during winter or spring of an hotel to meet tourist traffic.

Montreal, Que.

Tenders are in for plastering and the contract will be let in two weeks for bank and office building on St. Lawrence and Ontario, for Molsons Bank. Tenders are not yet called for electric and interior fittings. Turner and Carless, 49 Beaver Hall Hill, are the architects.

The Board of Commissioners has awarded the contract to Mr. G. M. Gest, 83 Craig Street West, for construction of conduit from Notre Dame Street to River front on St. Lawrence Boulevard, at $5,536. Mr. Clarkson, 1009 New Birks Building, is the engineer.

Medicine Hat, Alta.

Alberta Linseed Oil Mill Company, Limited, have decided to install the following new machinery in their newly-renovated factory:—Breaker, rolls, belting, pipe, tools, hydraulic pump, filter press. Also repairs to presses. None of the above has yet been ordered.

Niagara Falls, Ont.

Tenders will be called next week by Mr. W. J. Seymour, clerk, city council, for supply and erecting of 100 ornamental cast iron standards, to be used on River Road. Electric lamps will also be required. Mr. Geo. Foster, Superintendent Electric Lighting Company, is the engineer in charge.

The Queen Victoria Park Commissioners have awarded the contract for completing the Niagara River Boulevard through Bridgeburg and Fort Erie to Mr. J. C. MacNamara, St. Catharines. Contract price $32,000.

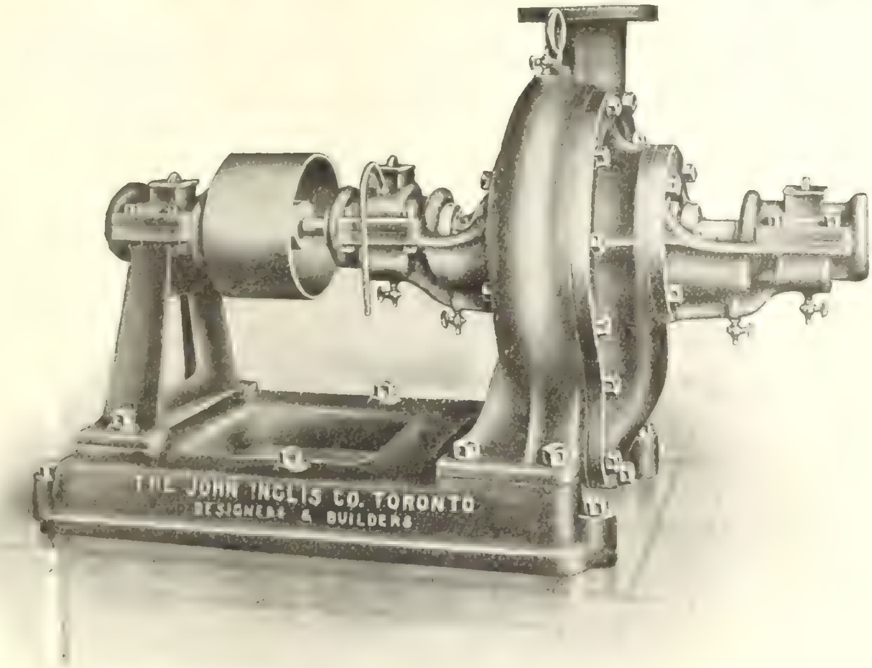
Ottawa, Ont.

Tenders will be called for balance of work on $114,000 pavement on Preston Street for the City Council. The surface draining work was started by day labor. Pavement will be laid in asphalt and stone-concrete. Mr. F. C. Askwith is the engineer.

Peace River Crossing, Alta.

The Provincial Government Department of Public Works are contemplating additions to bridges in this district. Traffic decks will be added to steel bridges over Smokey River on the Edmonton, Dunvegan and B. C. Railway and to bridge over Peace River on Canada Central Railway. Mr. John Stocks, Parliament Buildings, Edmonton, is Minister of Public Works.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

347 Adelaide Street West, Toronto

Iron Fences

Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

The GEO. B. MEADOWS

Toronto Wire Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

Universal Form Clamp

Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

Railway Contractors Supply Co.
Standard Bank Building, Toronto
Agents for Ontario and Eastern Canada

—Montreal representatives—
RAMSEY & KELLY, 511 Quebec Bank Building

"Hammer Brand"

Hard Wall Plaster

HARD-WALL PLASTER
HAMMER
HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada

Brick Today Stone Tomorrow

Properly made sand lime brick of the best materials will eventually turn to stone under the influence of nature. Those desiring strong and permanent building material should

SPECIFY "Harbour" Sand-Lime Brick

Harbour Brick Co., Limited
Lumsden Building
Toronto

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—[illegible] 5-barrel lots, $1.85 per bbl.; [illegible] $2.25 [illegible] lots, $1.55 on the track, [illegible] $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.60; King Edward Siding; $6.50 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$3.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 57c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 67c, per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 57c per gal. of 9 lbs. Raw linseed oil—in barrels, 54c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del. South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¼-in. and dust, $3.20.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks:
SYDNEY, N. S.
MONTREAL, QUE.
TORONTO, ONT.
FT. WILLIAM, ONT.

Sales Offices:
SYDNEY, N. S.
MONTREAL
112 St. James St.
TORONTO
18 Wellington St., E.

Mills and General Offices:
SYDNEY, N. S.

WIRE NAILS and other **WIRE PRODUCTS**

Union Water Tube Boilers

The steam producing end of a power plant is a matter of the most vital importance as far as the efficiency and economy of the plant may be concerned.

The four leading characteristics to be considered are SAFETY, EFFICIENCY, DURABILITY and ECONOMY.

The UNION WATER TUBE BOILER excels in these four principal characteristics. Strains due to unequal expansion cannot occur on account of the rapid, unrestricted circulation of the water and the corrugated drum-header connection.

Rapid circulation increases the efficiency by adding to the ability to absorb heat and prevent priming. UNION WATER TUBE BOILERS are made to meet the specifications of all the Provinces.

A special patent feature is used for delivering the feed-water into the drum, and taking care of deposits of sediment and removing same from the Boiler.

Rock & Power Machinery, Limited

Canadian Agents, Union Iron Works, Erie, Pa.

Head Office: 12 King St. E., TORONTO, Ont.

Branch Offices: VANCOUVER, SUDBURY, MONTREAL, COBALT, HALIFAX, and in the King Edward Hotel, TORONTO

THE NORTHWESTERN TERRA COTTA COMPANY

C. P. R. OFFICE BUILDING
Darling & Pearson, Architects

DOMINION BANK BUILDING
Darling & Pearson, Architects

Two prominent corners in Toronto
The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY
Chicago - Illinois

Agencies in all the large cities of Canada.

Canada Wire & Cable Co., Limited

Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes.

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Prompt shipments from Factory or nearest warehouse.

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The Ready Mixed

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Manufactured by

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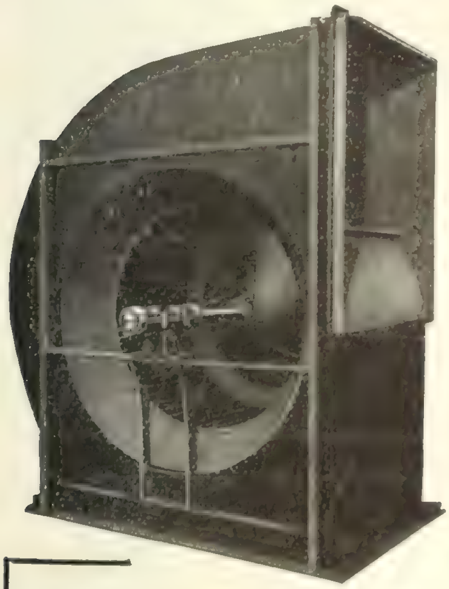

Single Inlet, Top Horizontal Discharge Sirocco Fans Built in sizes with capacities of 75 C.F.M. to 1,000,000 C.F.M. in all angles of discharge and arranged for either pulley, motor, engine or turbine drive.

Greatest in Capacity and Efficiency

Genuine **"Sirocco"** Patented
TRADE MARK.

Multi-Blade Fans and Blowers

—MADE IN CANADA—

Exhaustive tests conducted by our Experimental Department and by competent, unprejudiced engineers in competitive trials, has proven conclusively the "Sirocco" to be the most efficient commercial fan in the world. It occupies less space, and requires considerably less expenditure of power for a given duty than any other type of fan. Proper design and construction are the basis of the superiority of the "Sirocco" Fan, and make it the ultimate standard of excellence everywhere.

Learn concerning its principle of construction and why it is the best.

"Sirocco" Catalogue No. 201, valuable to Engineers, Architects and Contractors.

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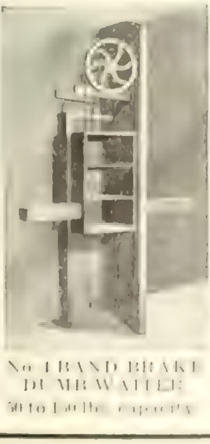
Calgary



No. 1 HAND BRAKE DUMB WAITER
50 to 150 lbs. capacity

CHELSEA

EXEMPLAR OF QUALITY

DUMB-WAITERS

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Write our agents for prices.

Chelsea Elevator Co.
NEW YORK

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Hardware Co. of Toronto,
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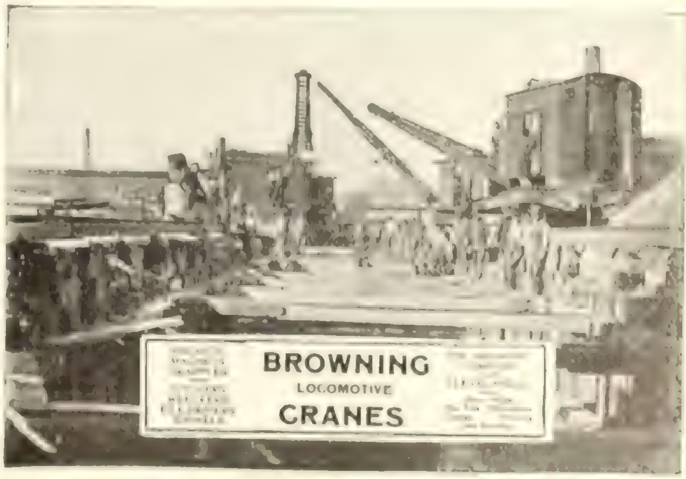

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68)

LUMBER (BUILDING MATERIAL)

([illegible] discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; [illegible] 4 in., $38, 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship- [illegible], 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-[illegible], $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white. $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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Architects and Building Surveyors
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Kingston, Canada

Geo. M. Miller & Co.
Architects
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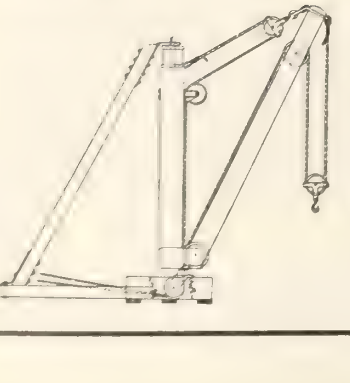

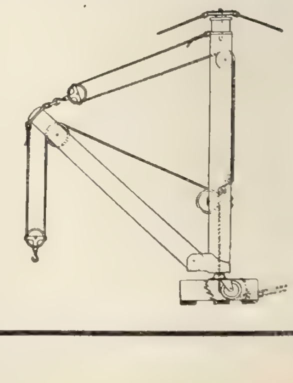

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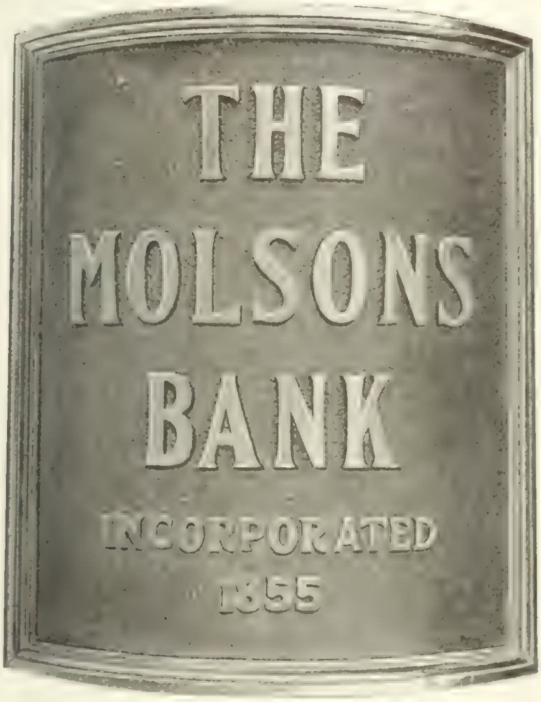
DERRICKS

HORSEPOWERS WINCHES OR CRABS

Standard sizes and capacity of derricks in stock for immediate shipment.

Get our prices—they will interest you.
All goods guaranteed.

MARSH and HENTHORN, LIMITED, Belleville, Ont.
Designers and Builders of Hoisting Machinery
Sales Agents: MUSSENS, LIMITED, Montreal, Que.



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Brass and Bronze

The next time you are in the market for signs of this class give us a chance to quote you. We are turning out some exceptionally high-class work in this line and would be glad to figure with you whether your order is large or small.

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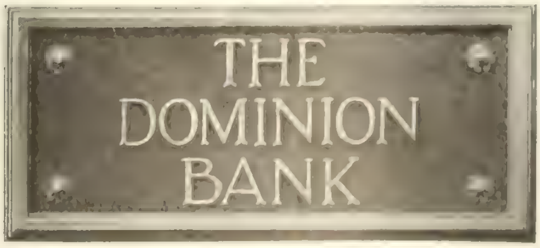

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Excelsior Plate Glass Co.
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Manufacturers of
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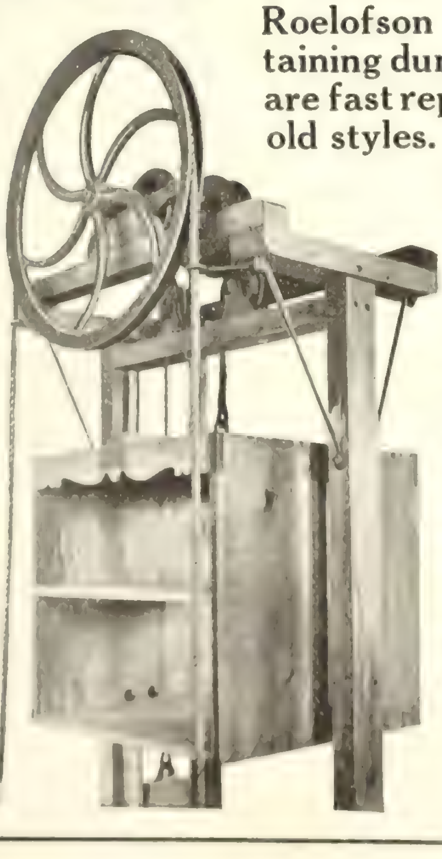

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They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost [illegible]

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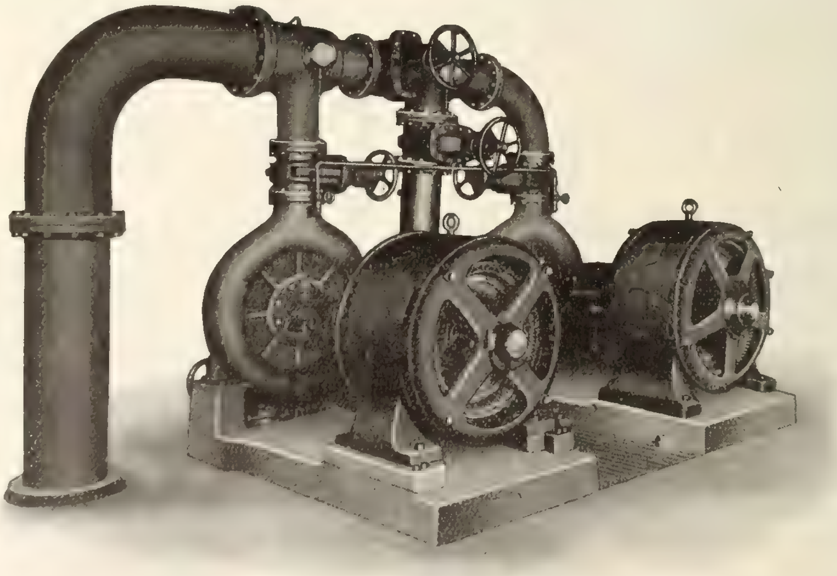
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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PONTOONS

and other similar works

Manufactured by
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Goold, Shapley & Muir Co.
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Towers and Tanks for all purposes.

Concrete Mixers

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Hoists

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Water supply outfits of every description.
CORRESPONDENCE SOLICITED

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A few dollars spent in advertising your proposals in

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would result in additional competition, which might save your city or town or your client many hundreds of dollars.

"Metallic"

Specified in the Contract

When "Metallic" Building Materials are definitely specified in the contract that fact denotes either or both of two things, viz.:—

1. The owner is convinced of the superiority of "Metallic" products, or—
2. The architect knows from experience that the beauty and value of any building is materially enhanced by them.

From your standpoint the word "Metallic" represents a considerable saving in time and labor. In other words, you get the same money for less time and labor and it would be good business on your part to consistently recommend the "Metallic" line.

THE "METALLIC" LINE INCLUDES
Galvanized or Copper Cornices, Skylights, Steel Shingles, Steel Ceilings and Walls, Ventilators, Steel Siding, Corrugated Iron, "Hayes" Patent Steel Lath, etc.

Catalogues and Prices sent promptly on request

THE METALLIC ROOFING CO.
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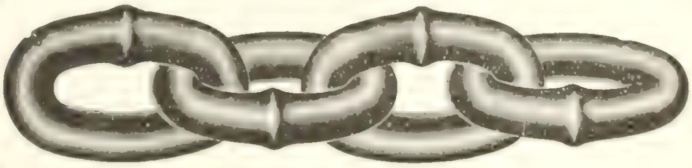
TORONTO AND WINNIPEG

McKinnon Electric-Welded



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25% More Weld — 25% More Wear

Sizes 3/16" to 3/4" inclusive.

The only welded chain made in Canada

Sold by Jobbers — Fully Guaranteed

Made by

McKinnon Chain Company
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A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

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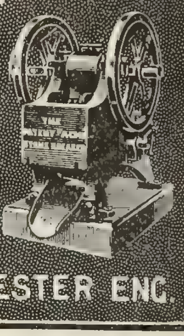
Represented by W. M Campbell, 25 Howland Ave., Toronto, Can.



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STONE BREAKER
FOR
STONE, ORE, ROCK ETC
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FOR ALL SERVICES
CONCRETE & TAR MACADAM MACHINERY
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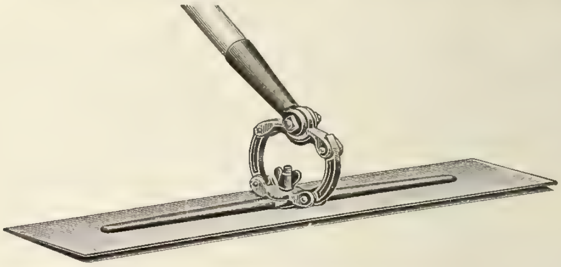

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We also build

Steel Structures
to support them.

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Built for C.P.R. Montreal

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IT WILL GIVE YOU A LINE ON THEM ALL.

THE HERBERT MORRIS CRANE & HOIST COMPANY, LIMITED.
EMPRESS WORKS PETER STREET TORONTO

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RANSOME Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

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1/4 to 60 Ton Daily Capacity

Water Purifiers
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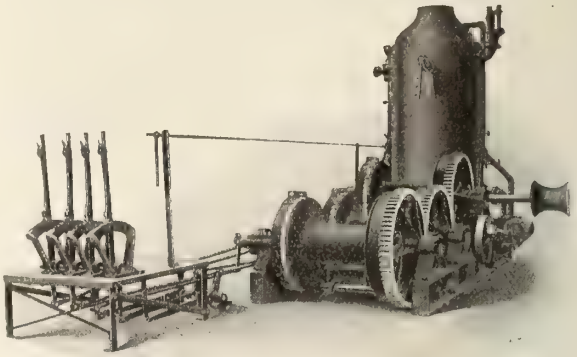
Hoisting Engines—Clam Shell Buckets—Derricks—Derrick Fittings—Centrifugal Pumps



Standard Three Drum Hoisting Engine with banked operating levers.

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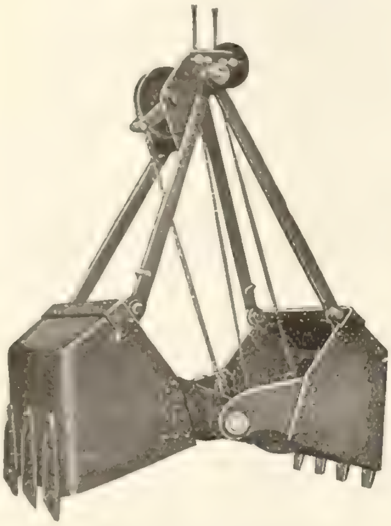

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Dipper, Clamshell and Hydraulic Dredges—Dump Scows—Excavators—Revolving and Travelling Cranes, etc.

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Specially suitable for lifts of 70 feet to 150 feet.

ADVANTAGES:

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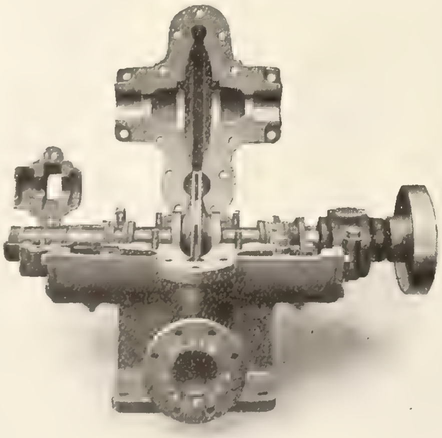

ADVANTAGES:

4—Large capacities, high efficiencies.

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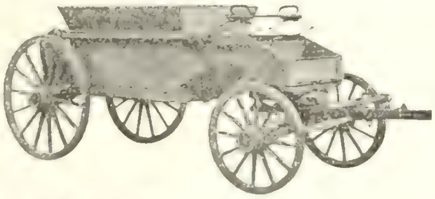

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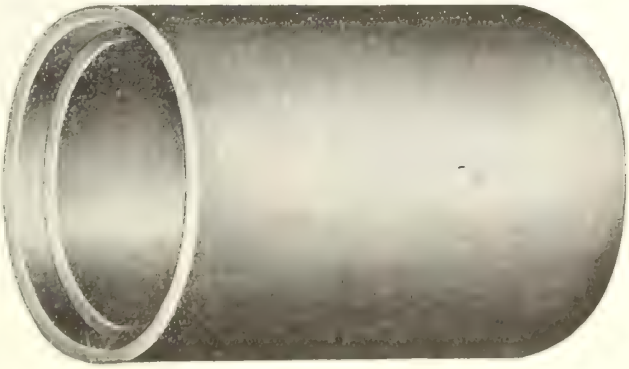
properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.



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STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

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Insulating Underground Pipes

Save time, labor and future trouble and **insure highest efficiency** not only for a few months but for **all the time.**

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Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe
for Water Works, Power, Irrigation, etc.

Withstands 250 lbs. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed complete.

WATER TANKS
all sizes.

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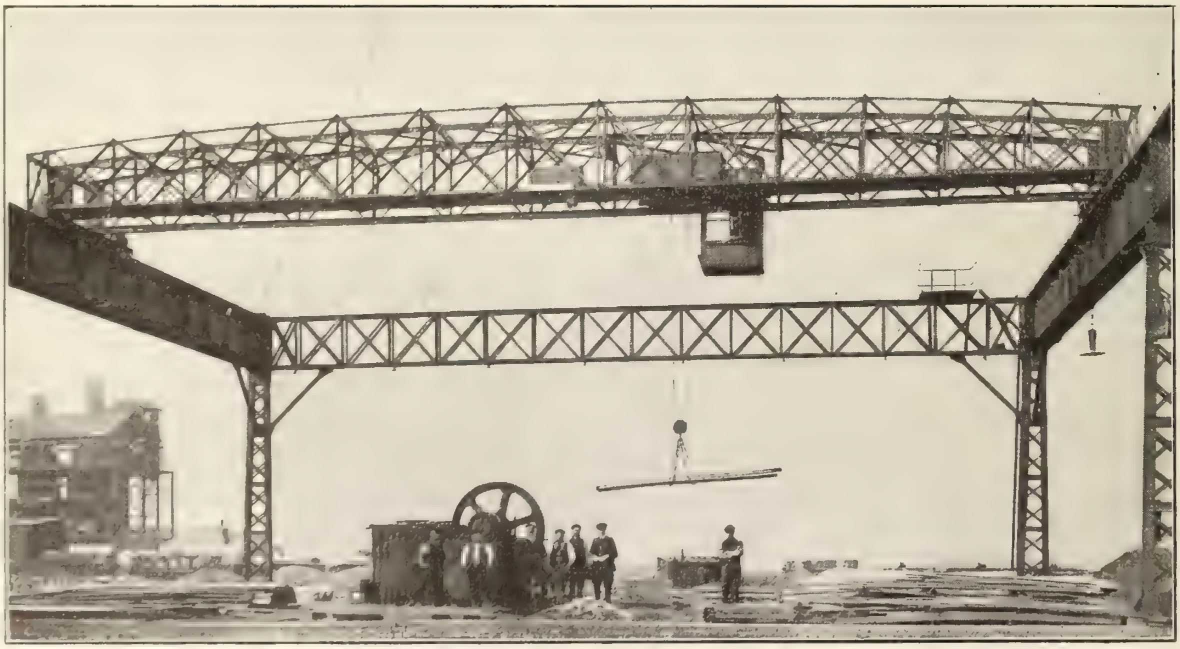

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Include Royce Crane Type Motors, Controllers, Over Hoisting Safeguard.

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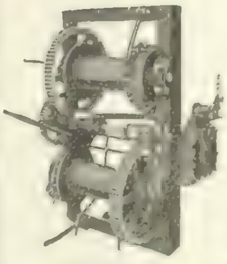

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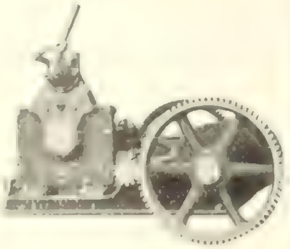

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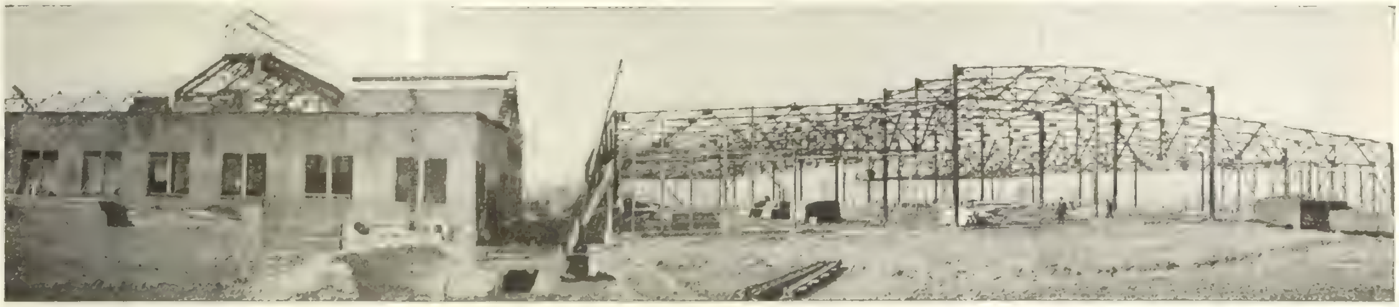

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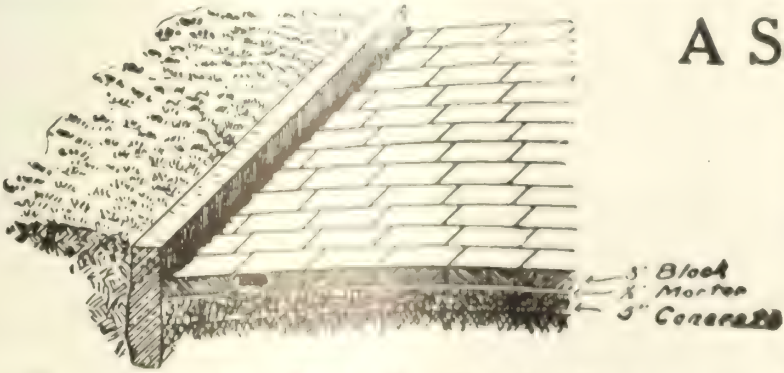

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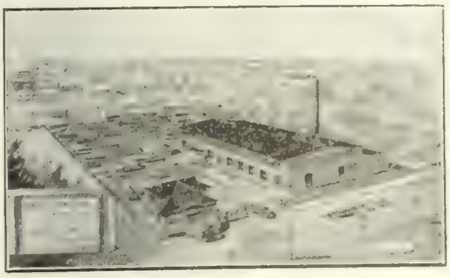
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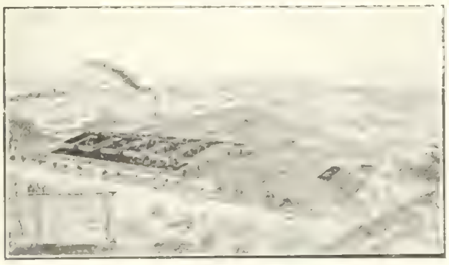
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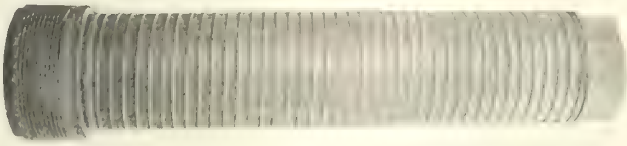

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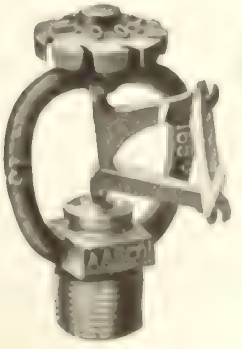

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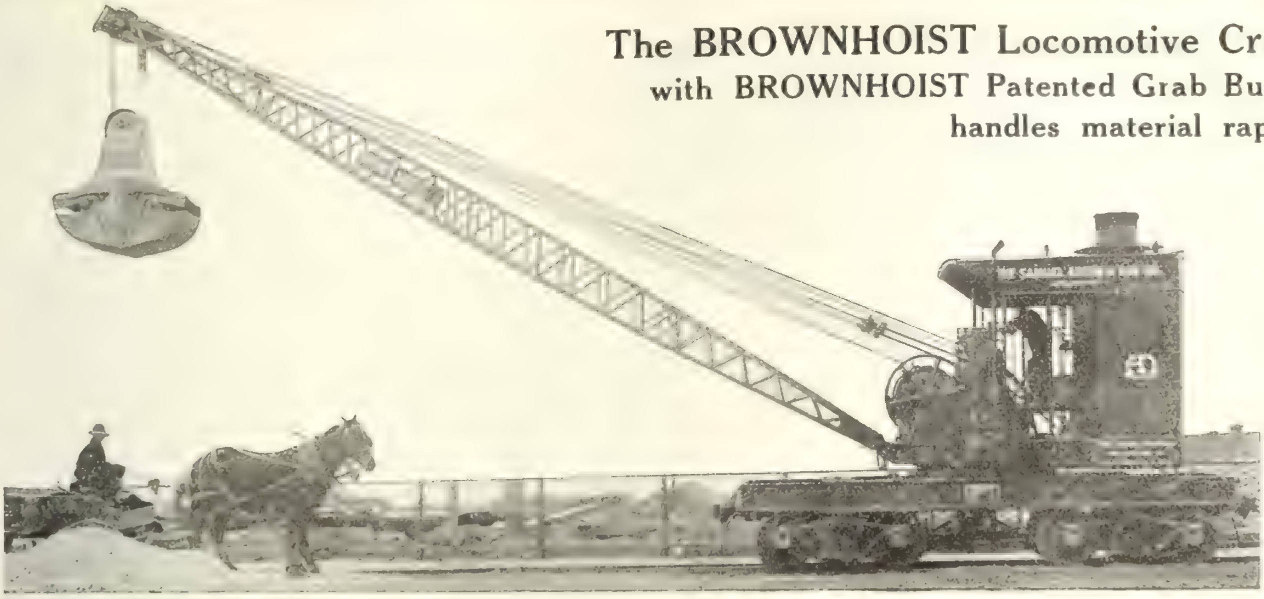

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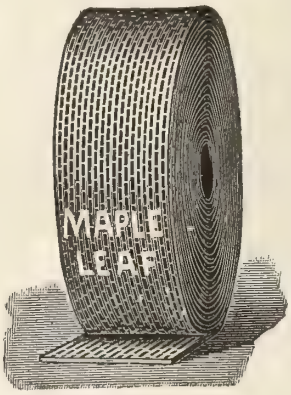

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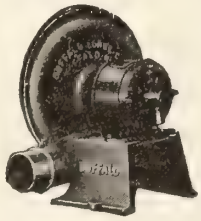

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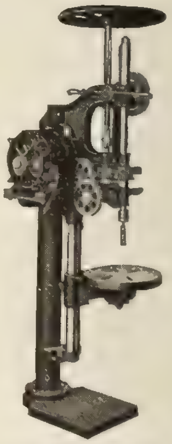

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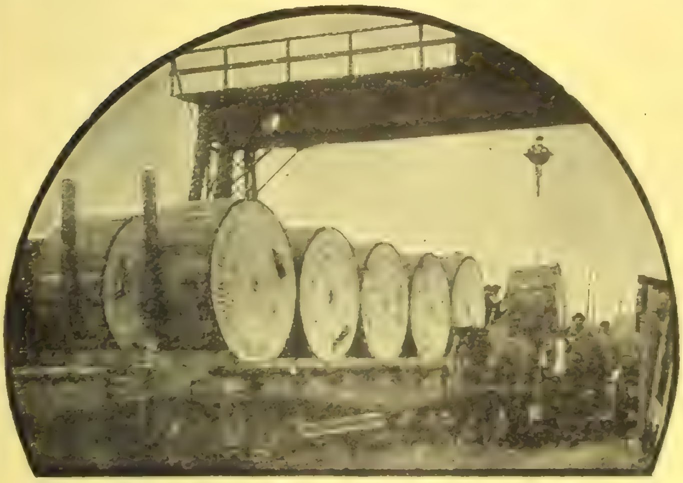

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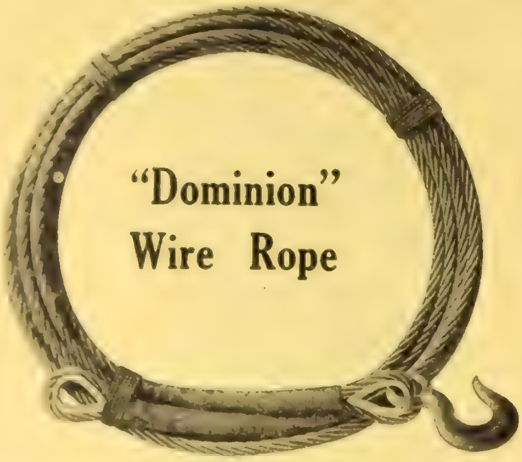

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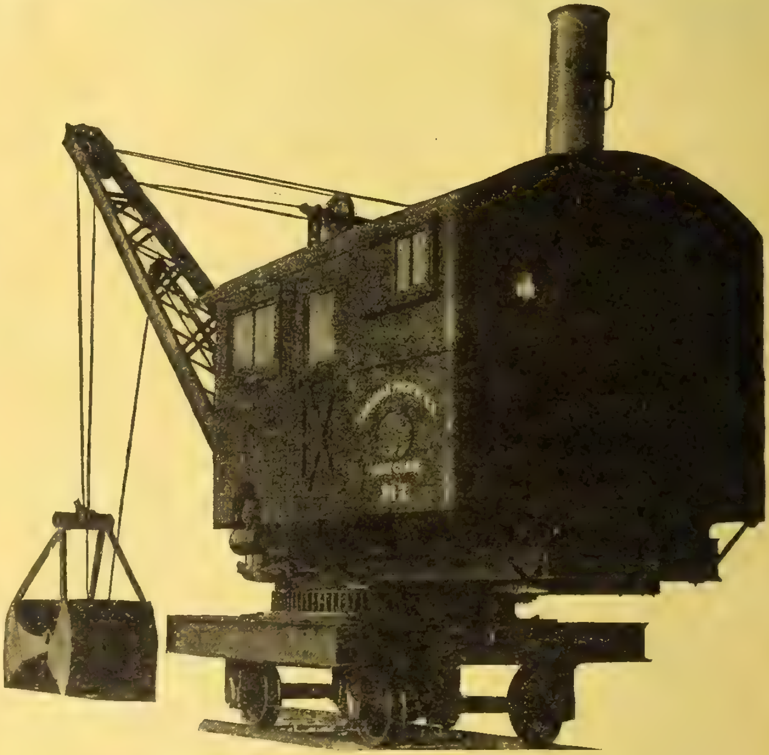

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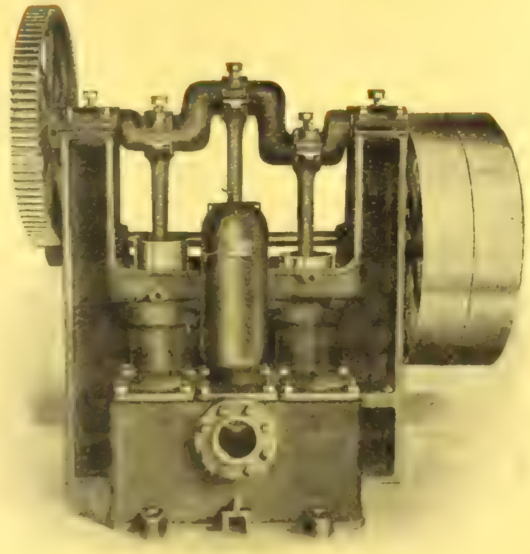

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Hamilton, Canada

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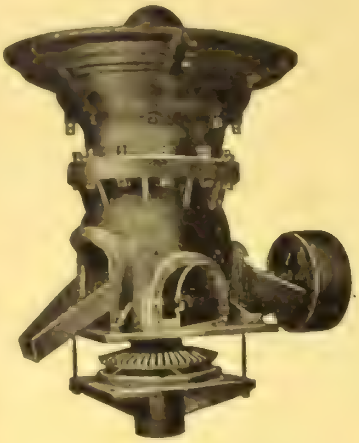


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN" Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

American Hoist & Derrick Company

ST. PAUL, MINN., U. S. A.

SOLD BY

General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto.
Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Ltd., Vancouver, B. C.
Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

"Business As Usual"

We have not, owing to the war, shut down any of our plants, discharged any of our workmen, reduced their hours of labor or cut their rate of pay.

We are doing "BUSINESS AS USUAL."

We intend to continue this policy to the extent of our ability, and, to that end, suggest that you confine your purchases, during the war and thereafter as largely as possible to goods "MADE IN CANADA."

When in the market for Rubber goods of any description—Belting, Hose, Packing, Tires or anything else—write or wire our nearest Branch for prices and information.

It is our desire to serve you.

"Business As Usual"

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

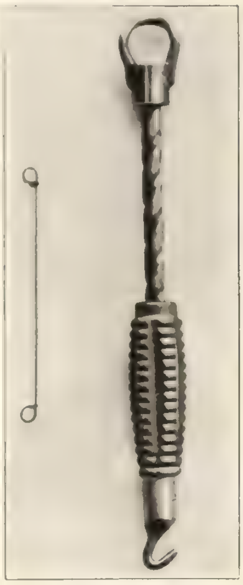
**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

28 "Service" Branches
Throughout Canada

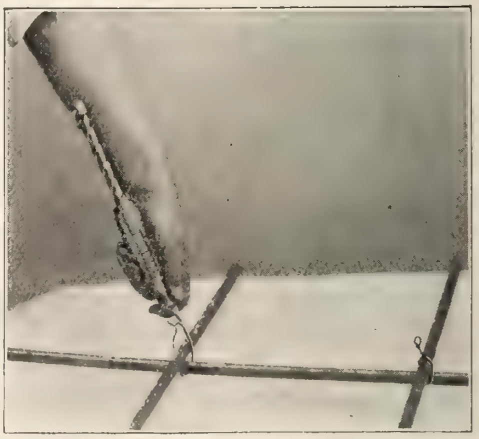
CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

Another Step Forward



Bates Tyer and Wire Ties for Reinforcing Bars

One man can tie three times as many reinforcing rods in place with the BATES TYER as he can by using pliers during the same period.



Reckon the speed, the low cost and uniform security.

One day's saving in labor will more than pay for the tyer.

Any desired length of wire supplied with the tyer.

Carried in stock.

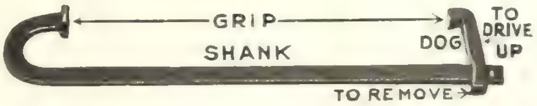
Mussens Limited

MONTREAL, 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

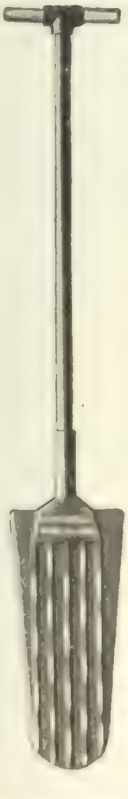
INSLEY

Adjustable Steel Form Clamps

Are economical on account of the rapidity with which forms can be assembled and the good condition in which the forms themselves are left.



CONCRETE



Spades and Tampers

The Ross Spade forces the stone back from the form, allowing the freer cement, sand and water to come to the vertical surface and produces a clear, white, smooth surface.

The **Andrew's Tamper** performs a similar duty for flat surfaces.

Every concrete contractor should have the tools in his equipment. They will save him money and produce better work.

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

CLASSIFIED INDEX TO ADVERTISEMENTS

The following regulations apply to all advertisers:—Eighth page, two headings; quarter page, four headings; half page, eight headings; full page, sixteen headings.

Adamantine Steel
- Hull Iron & Steel Foundries

Air Compressors
- Canadian Allis-Chalmers, Limited
- Can. Ingersoll-Rand Co., Ltd.
- Jenckes Machine Company

Architects
- Weeks, Arthur L.

Architects' Instruments
- Stanley Co., W. F.

Architectural Iron Work
- Aikenhead Architectural Iron Works
- Canadian Allis-Chalmers, Limited
- Canada Wire & Iron Goods Co.
- Dennis Wire & Iron Works
- McGregor & McIntyre
- Meadows Co., Geo. B.
- Steel & Radiation Ltd

Architectural Metal Work
- Feather & Roadhouse

Architectural Terra Cotta
- Northwestern Terra-Cotta Co.
- Toronto Plate Glass Imp't'g Co.

Ash Hoists
- Gillis & Geoghegan

Asphalt
- Aztec Oil Asphalt Company
- Asphalt & Supply Co.

Belting
- Can. Consolidated Rubber Co.
- Dominion Belting Co.
- Goodyear Tire & Rubber Co.

Blast Hole Drills
- Armstrong Manufacturing Co.

Blowers
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Can. Ingersoll-Rand Co., Ltd.
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F.

Boilers
- Canadian Allis-Chalmers, Ltd.
- Beatty & Sons, M.
- [illegible] Company of Canada
- Inglis Company, John
- Jenckes Machine Co.
- Leonard & Sons, E.
- Marsh & Henthorn
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Rock & Power Machinery

Boxes—Junction
- Standard Underground Cable Co. of Canada Limited

Brick
- American Enamelled Brick Co.
- Bradford Pressed Brick Co.
- Harbour Brick Company
- Hydraulic Press Brick Co.
- National Builders' Supply & Enamel Concrete Brick Co.
- North-Western Terra Cotta Co.
- Russell Shale Bricks
- York Sandstone Brick Co.

Brick Coating
- Wadsworth Howland Co.

Brick Dryers
- Canadian Buffalo Forge Co.
- Canadian Sirocco Co.
- Bechtels Limited
- Sheldons Limited

Brick Machinery and Supplies
- Bechtels Limited
- Crossley Machine Company
- Sheldons Limited
- Sutcliffe, Speakman & Co.

Bridges (Steel)
- Canadian Allis-Chalmers, Ltd.
- Canadian Bridge Co.
- Chicago Bridge & Iron Works
- DesMoines Bridge & Iron Co.
- Dickson Bridge Works
- Dominion Bridge Co.
- Hamilton Bridge Works Co.
- Mackinnon-Holmes & Co.
- Manitoba Bridge & Iron Works
- Maritime Bridge Company
- National Bridge Company
- Pittsburgh-DesMoines Steel Co.
- Sarnia Bridge Co.
- Structural Steel Co.
- Standard Steel Construction Co.

Buckets
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Lecky & Collis
- Manitoba Bridge & Iron Works
- Mills Bros.
- Radigan Company, John
- Sudbury Construction & Machinery Co.
- Thew Shovel Company

Builders Hardware
- Aikenhead Hardware Limited
- Can. Yale & Towne, Limited
- Richards-Wilcox Canadian Co.

Cable
- Canada Wire & Cable Co.
- Northern Electric Co.
- Standard Underground Cable Co. of Canada, Limited

Casements
- Hope & Sons, Henry

Cement
- Britnell & Company
- Bremner, Alex.
- McNally & Co., W.
- Morrison & Co., T. A.
- Ontario Lime Co., Ltd.
- Smyth & Ryan

Cement Coating
- Wadsworth Howland Co.

Cement Mill Machinery
- Hull Iron & Steel Foundries
- Jenckes Machine Company
- Sutcliffe, Speakman & Co.

Cement Tools
- Abram Cement Tool Co.

Cement Guns
- Cement Gun Company

Chain
- McKinnon Chain Company
- Woodhouse Chain Works

Chain Blocks
- Can. Yale & Towne Limited
- Morris Crane & Hoist Co., Herbert

Chimneys (Reinforced Concrete)
- Laurie Company, E.

Coal Chutes
- Manitoba Bridge & Iron Works

Coal Handling Apparatus
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.

Concrete Form Clamps
- Railway Contractors Supply Co.

Concrete Mixers and Appliances
- Badger Concrete Mixer Co.
- Canadian Allis-Chalmers, Ltd.
- Goold, Shapley & Muir Co.
- Hopkins & Co., F. H.
- Jaeger Machine Company
- Lecky & Collis
- London Concrete Machinery Co.
- Marsh Capron Company
- Mills Bros.
- Mussens Limited
- Rock & Power Machinery
- Sutcliffe, Speakman & Co.

Contractors
- Anglins Limited
- Dietrich Limited
- Eastern Pipe Construction Co.
- Wells & Gray

Contractors' Plant & Supplies
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- Badger Concrete Mixer Co.
- Beatty & Sons, M.
- Browning Company
- Canadian Allis-Chalmers, Ltd.
- Can. Billings & Spencer
- Canadian Locomotive Company
- Central Locomotive & Car Works
- Dake Engine Co.
- Dominion Lime Company
- Goodwin, Barsby & Co.
- Hamilton Mfg. Co., Wm.
- Hepburn & Co., J. T.
- Honig & Mock
- Hopkins & Co., F. H.
- Jaeger Machine Company
- Jenckes Machine Company
- Lecky & Collis
- Marsh & Henthorn
- McKinnon Chain Co.
- Mills Bros.
- Morris Machine Works
- Montreal Locomotive Works
- Mussens Limited
- Radigan Company, John
- Railway Contractors Supply Co.
- Royce Limited
- Schell Foundry & Machine Co.
- Stinson-Reeb Builders' Supply Co.
- Sudbury Construction & Machinery Co.

Conduits
- Can. H. W. Johns-Manville Co.,
- Conduits Co., Limited
- Orpen Conduit Co., Ltd.
- Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
- Sudbury Construction & Machinery Company

Conveying Machinery
- Goodwin, Barsby & Co.
- Sturtevant Co. of Can., Ltd., B. F.
- Sutcliffe, Speakman & Co.

Core Drills
- Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
- Can. H. W. Johns-Manville Co.
- Metallic Roofing Co.
- Pedlar People Limited
- Sarnia Metal Products Company

Crank Shafts
- Canadian Billings & Spencer

Cranes, Travelling and Locomotive
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Morris Crane & Hoist Co., Herbert
- Northern Crane Works
- Rock & Power Machinery, Ltd.
- Roelofson Elevator Works
- Royce Limited

Creosote Stains
- Cabot, Inc., Samuel

Crushed Stone and Granite
- Hagersville Contracting Co.
- Ontario Lime Co., Ltd.
- Rogers Supply Company
- Smyth & Ryan

Crushers (Stone and Rock)
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- Goodwin, Barsby & Co.
- Hamilton Mfg. Co., Wm.
- Hopkins & Co., F. H.
- Jenckes Machine Co.
- Lecky & Collis
- London Concrete Machinery Co.
- Mussens Limited
- Rock & Power Machinery
- Sutcliffe, Speakman & Co.

Culverts
- Pedlar People
- Sarnia Metal Products Company

Cupolas (Foundry)
- Northern Crane Works

Derricks and Derrick Fittings
- Aikenhead Hardware Limited
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Hepburn, John T.

Dredges
- Beatty & Sons, M.
- Browning Company
- Canadian Equipment Co.
- Morris Machine Works

Dredging Chain
- McKinnon Chain Company
- Woodhouse Chain Works

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- Canadian Allis-Chalmers, Ltd.
- Canadian Buffalo Forge Co.
- Canadian Ingersoll-Rand Co.
- Lecky & Collis

Drill Steel Sharpeners
- Canadian Ingersoll-Rand Co.

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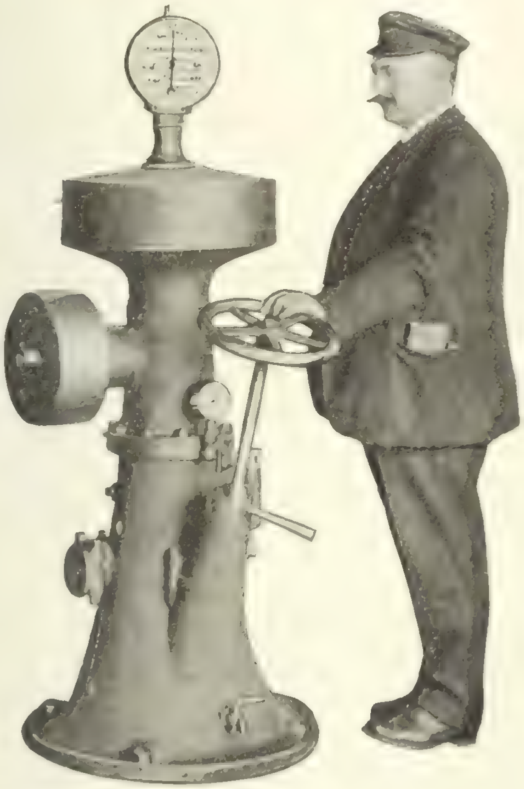


MADE IN CANADA

Water Turbines
Centrifugal Pumps

Patronize Home Industry and let us Quote on Your Requirements

Boving & Co. of Canada Limited

94 Grafton Ave
Moose Jaw, Sask.

Head Office
164 Bay St.
TORONTO

London Bldgs.
Vancouver, B. C.

Factory, Lindsay, Ontario

Mexico City Wellington Cairo London, Eng. Tokyo Johannesburg Rio De Janeiro

The Daylight is There

Harness it with LUXFER Prisms

Every new building should be equipped with Luxfer Prisms in order to get daylight into the interior.
Once installed, "Luxfer" costs nothing to maintain.
Luxfer sidewalk prisms are set in wrought iron frames which cannot warp or sag.
Luxfer is the one prism that will give definite results—no guess work.

Always specify the safe system, "LUXFER"

Luxfer Prism Company, Limited
100 King St. West, Toronto

A Liberal Education in Highway Improvement

Over $200,000,000 has been spent during the past year in road construction and maintenance in the United States, besides the enormous sums expended for paving in the cities and smaller towns. In no former year has so much been accomplished in highway improvement. The result of this great activity will be reflected in the Fifth American Good Roads Congress, the Eleventh Annual Convention of the American Road Builders' Association, and in conjunction with it the

Sixth Good Roads Show

To be held at the International Amphitheatre, 43d and South Halsted Streets

Chicago, Ill., December 14-18, 1914

Every highway official, engineer and contractor, as well as every other person interested, is cordially invited to be present. All the important phases of road and paving work will be presented and discussed by the men who are recognized as the leading experts in the science and art of road building and street paving throughout the United States and Canada. After each subject has been presented by a formal paper, the topic will be open for discussion to anyone who wishes to take part.

The Sixth Good Roads Show will, without exception, be the largest and most complete exposition of materials, machinery and methods used in highway improvement that has ever been held. This feature will be most interesting and, in fact, will in itself be a liberal education in the subject of highway improvement.

Make Up Your Mind To Go

to this convention and congress and participate in the proceedings. The information you will secure and the ideas you will get will pay you many times over in your work during the coming year. Special Railroad trains from New York, Philadelphia and Boston.

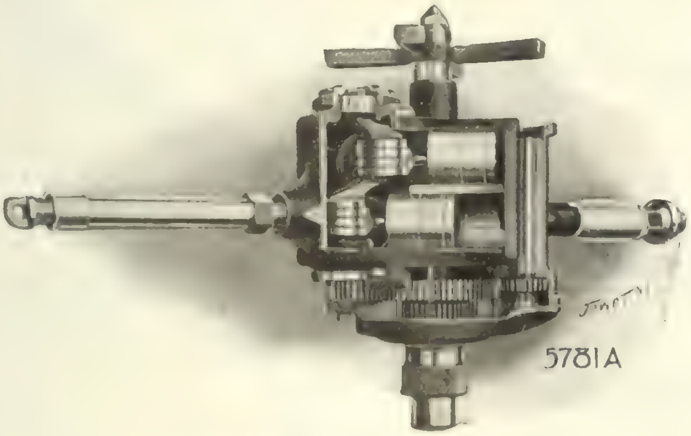
Write for full information concerning programme, hotels, train service and reduced rates.

American Road Builders' Association
150 Nassau Street New York, N. Y

Hotel Convention Headquarters, The La Salle, Chicago

For Drilling, Tapping and Reaming Metals; For Driving Studs, Flue Rolling and for Wood Boring

USE "LITTLE DAVID" PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

You'll find "LITTLE DAVID" Drills the most satisfactory tools you have ever used.

CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver

Haulage and Hoisting Ropes

DERRICK AND DREDGE ROPES
ROPES FOR HOUSE MOVING
SAW CARRIAGE ROPES
SMOKE STACK STAYS

Standard or Lang's Lay.

WIRE ROPE FITTINGS WIRE ROPE GREASE

The B. Greening Wire Co. Limited
Hamilton, Ont. Montreal, Que.

HERRINGBONE COPPER ALLOY LATH

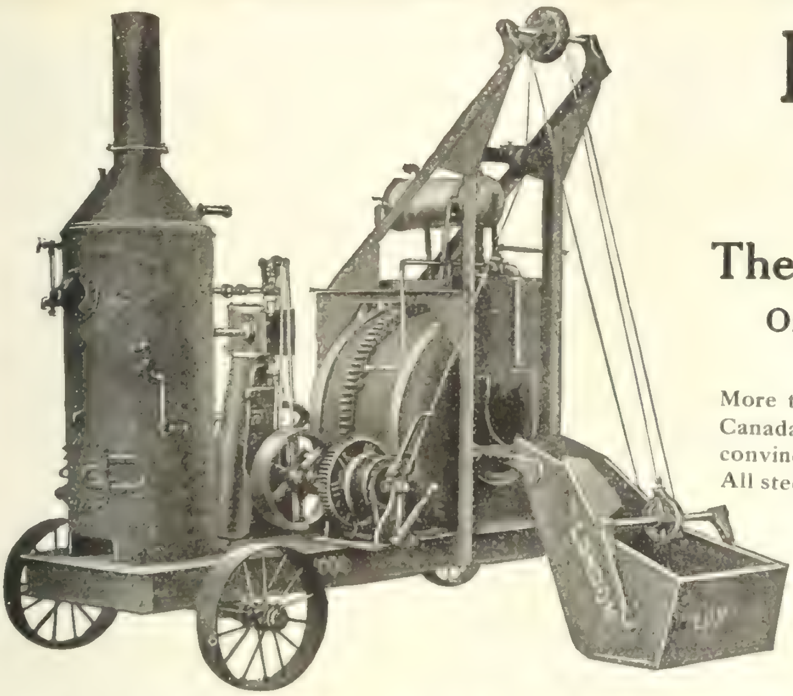
The "No Increase In Price" Policy

Herringbone Copper Alloy Lath, gauge for gauge, will resist hard wall plaster corrosion sixty-one percent better than lath made from ordinary steel. In other words ordinary metal lath would have to weigh sixty-one percent more than Herringbone Copper Alloy lath in order to be equally efficient. This means it would have to cost about fifty percent more in order to compete with copper alloy quality.

Yet when Herringbone Metal Lath was changed from ordinary steel to copper alloy the old price to the consumer was not changed. Same price—sixty-one percent more quality. At first glance it would appear that the management here lost a great opportunity.

We believe that in adopting this generous policy we have gained, instead of lost, an opportunity. For even before Herringbone lath was made of copper alloy its superior stiffness, selvage edge, and plaster saving qualities made it the standard specification. And now, with this final improvement in quality and the price unchanged, its superiority is absolutely unasailable. Every thinking man will use Herringbone Copper Alloy Lath now.

Clarence W. Noble - General Sales Agent
117 Sun Life Building, Toronto
Metal Shingle & Siding Company, Manufacturers



Built Like a Battleship

The London Concrete Mixer

Once a specialty—now a question of our output capacity

More than 1200 London mixers are in use throughout Canada today. Also many in foreign countries. This convincing evidence of the superiority of the London All steel construction with few working parts. London Concrete Mixers are built in twenty-three different sizes and can be fitted with any equipment. We manufacture a complete line o concrete machinery and cement working tools

We are the Largest Manufacturers of Concrete Machinery in Canada

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory : Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES

Winnipeg—565 Portage Ave.—W. H. Rosevear, Manager
Calgary—622 9th Ave West—P. D McLaren, Manager.
Toronto—112 York Street—G. B. [illegible] Manager
Halifax—68 Upper Water Street—R. R. Power, Manager.

AGENCIES

Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

CONTRACTORS' LOCOMOTIVES

[illegible]

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

Drop Forgings
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Dump Cars, Wheels, etc.
  [illegible] Limited
  Manitoba Bridge & Iron Works
  Schell Foundry & Machine Co.
  Sheldons Limited

Dump Carts and Wagons
  Deere Plow Co., John
  McNally & Co., Wm.

Drying Apparatus
  Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
  Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
  Gent & Company

Electric Steel Castings
  Electric Steel & Metals Co.

Electrical Supplies
  Northern Electric Company

Elevators
  Chelsea Elevator Company
  Roelofson Elevator Works
  Turnbull Elevator Co.

Enamelled Brick
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  Canadian Buffalo Forge Co.
  Canadian Sirocco Company
  Inglis Company, John
  Jenckes Machine Company
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Rock & Power Machinery

Engineers (Civil and Mechanical)
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  Cape Company, E. G. M.
  Chipman & Power.
  Dominion Engineering & Inspection Company
  Farmer, John T.
  Galt Engineering Co., John
  Lea & Ferguson
  Mitchell, C. H.
  McDougall, Geo. K.
  Pullar, H. B.
  Tyrrell, H. G.

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  Beatty & Sons, M.
  Brown Hoisting Machinery Co.
  Canadian Equipment Co.

Exhaust Heads
  Canadian Buffalo Forge Co.
  Sheldons Limited

Expanded Metal
  Pedlar People Limited

Fans
  Canadian Sirocco Company
  Sheldons Limited
  Sturtevant Co. of Can., Ltd., B. F.

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  Can. Consolidated Rubber Co.

Fuel Economizers
  Sturtevant Co. of Can., Ltd., B. F.

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  Ferranti Electrical Co.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Filtration Plants
  verMehr Engineering Co., John.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry
  Mussens Limited
  Pedlar People Limited
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Floor Surface Machines
  Wayvell Chappell & Co.

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.

Gasoline Engines
  Armstrong Mfg. Co.
  Goold, Shapley & Muir Co.
  Mills Bros.

Glass
  Consolidated Glass Company
  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co

Hammer Drills
  Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock and Power Machinery
  Royce Limited

(Continued on Page 14)

Made In Canada

This patented hoist removes ashes from cellar to street level. It also hoists or lowers kegs, barrels, cakes of ice, etc., doing its work quickly and safely. With it one man can raise a maximum weight of 500 lbs. at a speed of 30 feet per minute.

Some Canadian Installations

Kingston Collegiate Inst., Kingston
Station F. Post Office. Montreal
[illegible] Armory, Winnipeg
Poupard Street School, Montreal
Watkins Medical Bldg., Winnipeg
Weslyn College, Montreal
[illegible] Bldg., Calgary
Quappellee Sanitarium, Winnipeg
Royal Theatre. Fort William
Mont. Baby & Fdlg. Hosp., Montreal
Central School, Swift Current
No. 3 Fire Station, Montreal
Elmwood School, Swift Current
[illegible] Bank, Winnipeg
Ford Motor Co., Montreal
Engineers' Club, Montreal
[illegible] Building, Montreal
Normal School, Victoria
Bank of Brit. N. America, St. John
Dandurand Building, Montreal
[illegible] Bldg.,
Winnipeg
Drinkle Building, Saskatoon

The G & G
(Patented)
Telescopic Hoist

With compound gear and brake attachment.
When not in use no part shows above sidewalk.
Strongly constructed of best materials. Very simple to operate and takes up no room in cellar.

Write to nearest agents for illustrated booklet, prices and specifications.

GILLIS & GEOGHEGAN
549 West Broadway, New York City

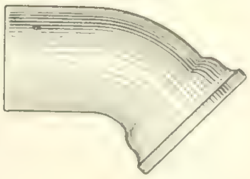
Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

W. T. Grose
Agents for Manitoba Saskatchewan, Alberta
Winnipeg

Warren Pipe



Ask us to quote on your next order—any size, 3″ to 60″ diameter, bell and spigot or flange—also special fittings and castings of all kinds.

For fifty-eight years we have manufactured the best quality of cast iron pipe.

Information and prices on request.

Warren Foundry
and Machine Co.
11 Broadway - NEW YORK

Woodhouse Chains for Contractors and Engineers have a great record

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For buildings of this type, therefore, Barrett Specification Roofs have no substantial competitor.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

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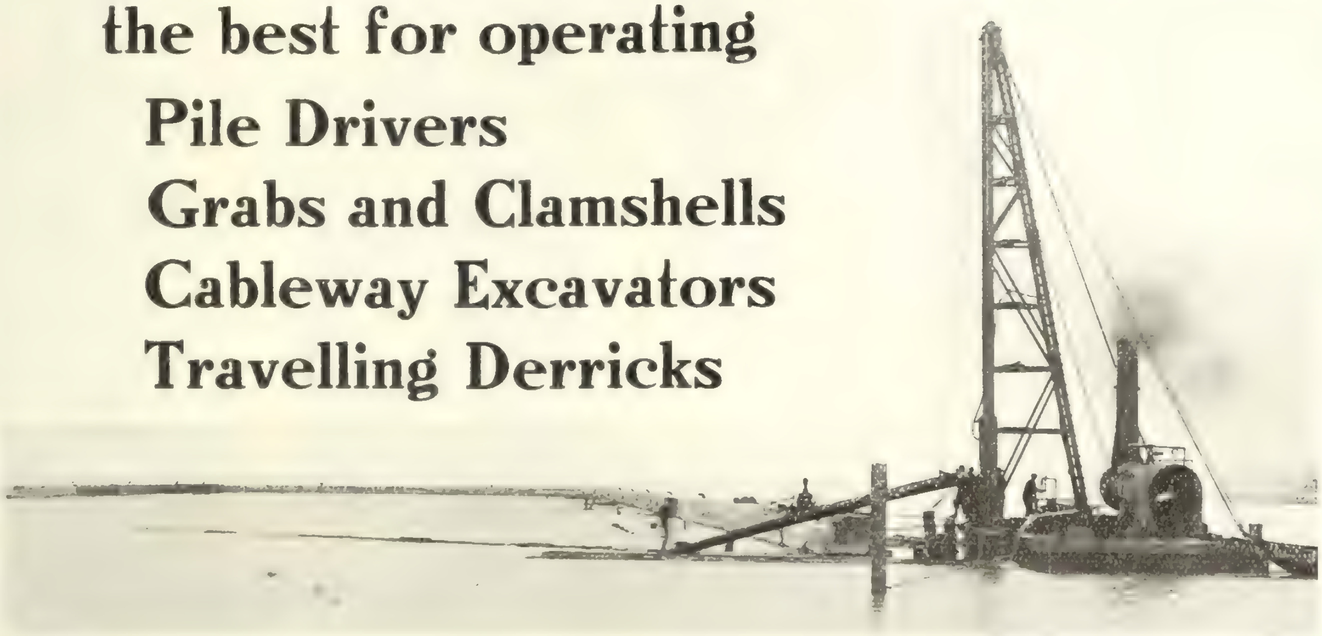

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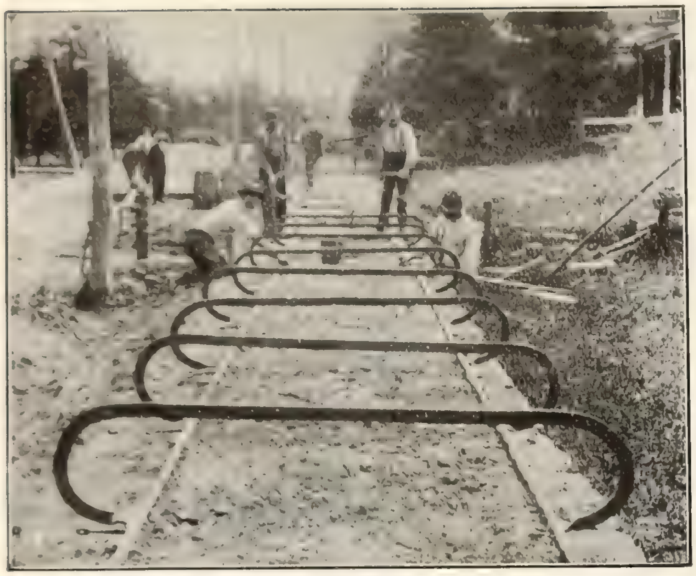

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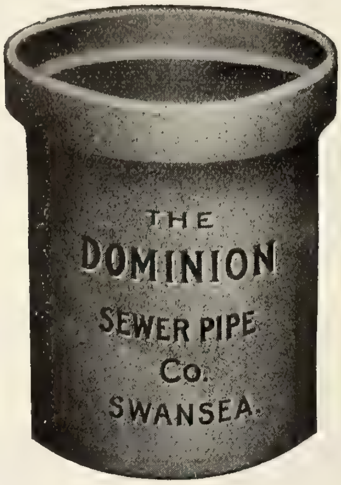

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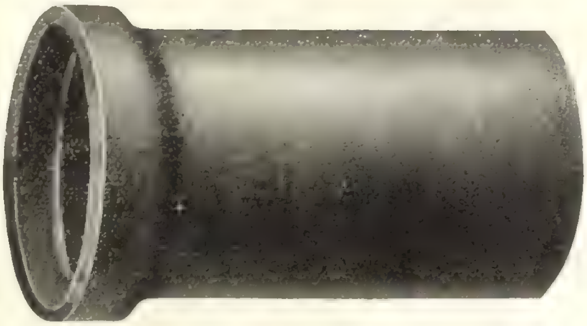

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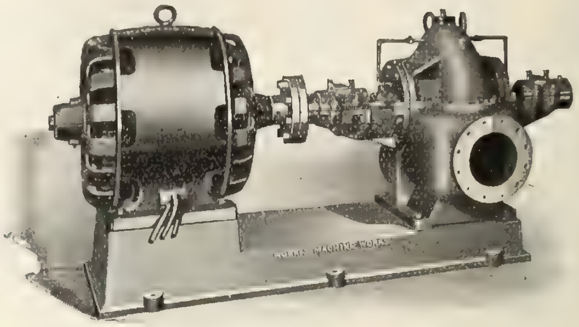

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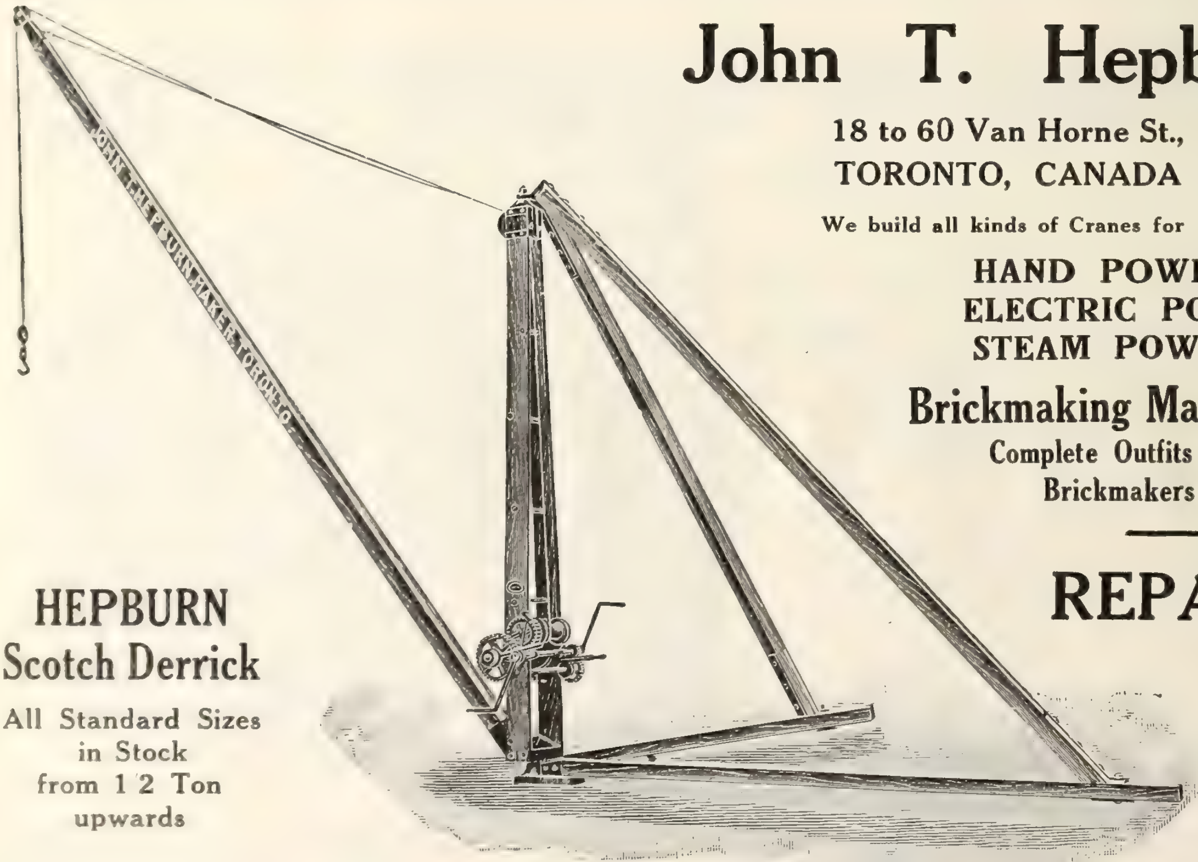
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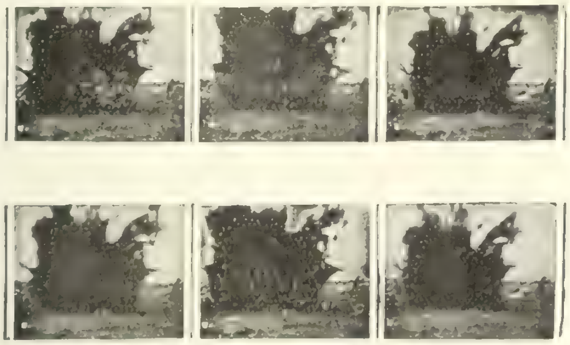

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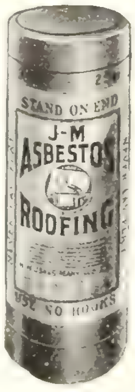

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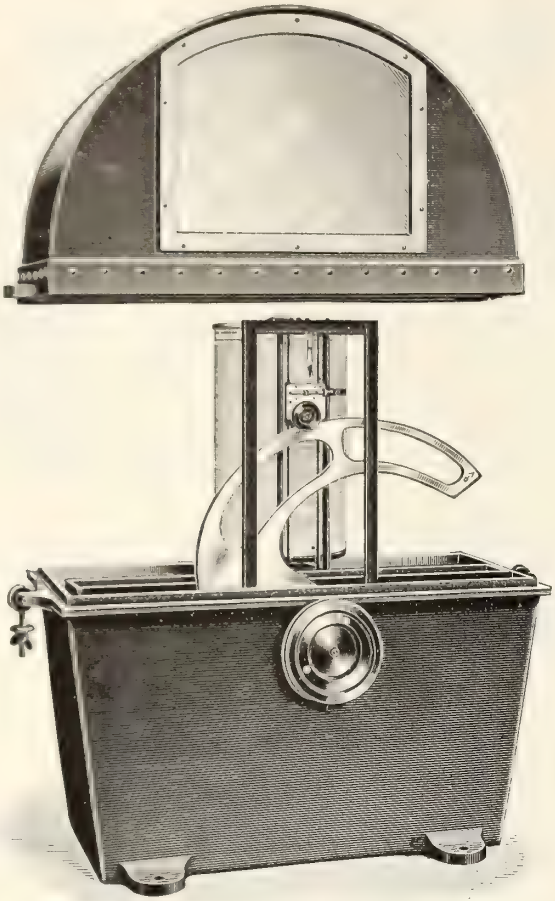

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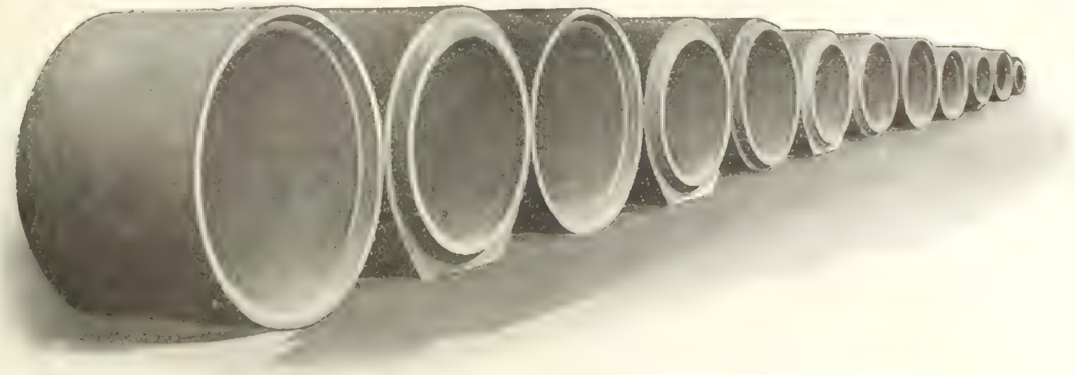

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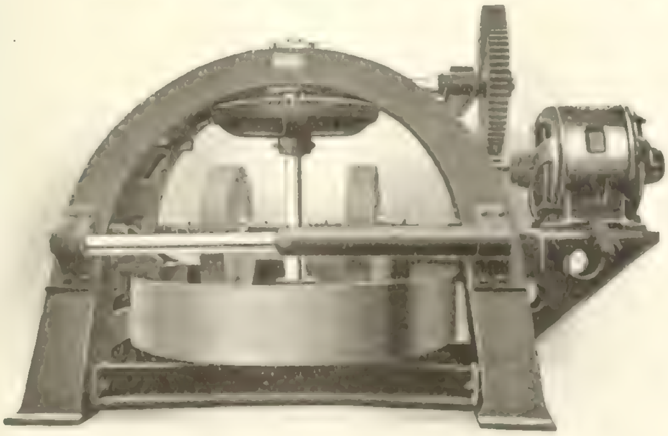

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The Hopeful Influence of Trade Adjustment

IT is encouraging to note that the last traces of the panic which broke out in some influential quarters at the beginning of the war are fast disappearing. In spite of the general depression of trade there is a note of optimism in the recent statements of industrial leaders, financial men and others. As far as Canada is concerned, one of the most interesting statements was made in Washington a few days ago by Sir Geo. Paish, the eminent economist, who expressed the opinion that in many ways the war would stimulate trade greatly and that the present situation would impel the United States to enlarge its operations as a money-lender. According to this authority, our neighbor to the south will have to decide whether to continue to lay additional tracks on its railroads, construct costly terminals and build beautiful buildings, or whether it will take up the task of helping to furnish capital for the world's development, and particularly for the newer countries on the American continent. Sir George points out that trade activity is a normal condition during war time and that the industries which become very active because of the war cannot fail to have a buoyant effect upon many others. So far from anticipating depression, or continued depression, next year, Sir George speaks of the possibility of a considerable trade revival, there being every promise that the embarrassment in connection with the marketing of the U. S. cotton crops —which is one of the underlying factors—will be removed. Having regard to the constructional projects of our provincial governments, municipalities and railroads, such views coming from such an authority, are reassuring.

In regard to what has been said about the impetus provided by war orders, it is not difficult to substantiate theory by fact. Quite a number of Canadian firms have fair-sized initial orders for steel shells, while contracts for barbed wire have been productive of activity in several other plants. Mr. J. H. Plummer, President of the Dominion Steel Corporation, stated in the course of a recent interview that his firm was receiving a considerable amount of new business from England. Contracts for many other lines are being withheld from Canadian manufacturers pending enquiry as to their ability to turn out the orders on time. We are told on good authority that one block of such orders is for 1,000,000 shirts, 1,000,000 pair of shoes, 1,000,000 sweater coats, 1,000,000 pair of socks and large quantities of underwear. With the award of such contracts in Canada, a wide industrial range would be affected for the better.

This readjustment of conditions is what we predicted from the first. Immediately following the declaration of war everything became disorganized and in many quarters the greatest depression prevailed. The situation was without precedent. The Kaiser loomed up as some frightful octopus whose tentacles would reach out and envelop the world. Such was the fear of God which a one-man military machine could put into the hearts of some at least of the people of the Empire. Now all this is changed, and with a further demonstration of Great Britain's slow-moving but inevitable might, confidence has been restored in a large measure and the men of little faith are joining forces with those who stood their ground from the first.

It is possible that the war may last some time, although by some optimists it is declared that next Easter will see the end of hostilities. But in any event we can afford to wait. We can hold our own and more; we can reach out after new business and get it; and when the war is over we can make up for the business which we have been obliged to sacrifice temporarily.

The Standard of Merit

OPPORTUNITY is a word whose initial letter resembles more nearly than any other the emblem of infinity. The reflection bears upon the approaching opportunity of Canadian manufacturers to extend their overseas trade. This opportunity could not have been brought about for many a long year by any other medium than the war and it should be made the most of. The extent to which the circle of opportunity will enlarge must be governed appreciably by the manner in which the initial orders are executed in accordance with the specifications and requirements of the various authorities and private firms abroad.

The fundamental basis of trade expansion is efficiency. This fact cannot be impressed upon our manufacturers too strongly at the present time. Canada's place and reputation in the British Empire for the next century may depend upon the course she takes during this great conflict. It were a strange contradiction to contribute some of the best of our manhood on the one hand and on the other to condone anything like scamped work in the execution of war contracts. Such things have been done, but it is for Canada to prove herself above suspicion.

At this time it is in our best interests for the initiative to be taken by manufacturers who combine a full measure of business enterprise with an unswerving devotion to the basic principles of integrity.

Love Among the Ruins.

(From the London Builder)

SOME of us have probably been led to wonder how it comes about that in the midst of the agony of human sacrifice and in all the tragedy of slaughter there is still room in hearts and minds for grief at the destruction of ancient buildings. War adjusts values. It makes us face the very elements of existence, and throws into the shades of dim distance many things which in days of peace make the foreground of our daily landscape. Are we, one is tempted to ask, allowing sentimental archaeology to linger on and to be cherished when it ought with the other unnecessaries of life to be set aside in these days of fierce reality? The answer is to be found in a few thoughts on the meaning of patriotism. Sentimental archaeology may not, after all, be as empty a thing as the two words suggest. "Sentimental" may imply sentiment rather than sentimentality. Archaeology may indeed mean what it literally means, the knowledge of certain ancient things. Sentiment is what heroes die for, and for ancient things, such as world-old truths, they both die and live.

By this time there is many a home in England in which the poignancy of a personal sorrow overshadows every thought except a sad joy in having been chosen to make for England the sacrifice which is more bitter than death. But among those who merely weigh with deep national sympathy the losses of their nation and of her Allies there is certainly a strong sense of the horror of battered buildings, of towns and churches demolished and disarrayed which holds its own against and alongside of the lament at the fall of brave men.

The defacement of Reims, the effacement of Louvain are calamities which touch the springs of regret not merely in students of architecture, in churchmen, and in scholars, but in all to whom the brotherhood of man is a reality. And why?

Let us think of patriotism. Patriotism is the love of country, and by the common consent of all civilized and uncivilized nations there is but one measure of that love—a willingly given death. The country for which its sons will not die is a country of no account. But for what do these men give their lives? Not surely for a barren aggregation of acres. There is nothing in mere land, though there may be something in mere landscape, for which the sacrifice of wounds and death would be cheerfully paid. No. The potency of land is that it is the measure of fellowship in space, and the potency of certain other things is that they are the measure—nay, the vehicle—of that same fellowship in time. When Aristotle discovered that man was "a political animal" he signified that man is the brother not only of his chosen contemporaries, but of a line of predecessors and of anticipated successors. And this truly is the secret of that patriotism for which men pay the highest payable price.

In a small way this is illustrated by the home. Modern civilization, it is true, accustoms men to think lightly of a change of house; in fact our uprootings from one place of shelter to another are so frequent that if we did not purposely deaden the instinct of our local affections life would be unbearably saddened by removals. In a way we find an anodyne by lavishing our love upon the movable parts of the home. A loaded furniture van is a thing to which a right-minded man might kneel bareheaded. It is to some fellow-creature the ark of the covenant. What the poor call their bits of things are veritably a slice of that possession for which in its national entirety we send forth our guns and our ships. And this not because it is property, but because it is a symbol of companionship. Again, these possessions, being inanimate, have for a time at least the power to evade death and so outlive their possessors. Heaven forbid that this should be an argument for the perpetual hoarding of family furniture! We recall the affectionate reverence for those inanimate companions of humble homes merely to prove the claim of greater things which, being beautiful in themselves and of long and honourable life, outlive not merely their first owners and creators, but generations of their successors. Great and noble buildings, time-hallowed churches, ancient towns whose streets have been worn by generations of faithful citizens—these are things which, being in themselves mere by-products of national energy, are yet sacred and as far as may be abiding pledges of the continuity of race. They symbolize, or rather they are a part of, the common heritage of the men who own them. Apart from beauty, apart from function, they are in themselves evidences and outgrowths of that continuity which makes a man one with the past and future of his country. And when to this property of materialized fellowship is added the grace of beauty and the equal grace of hallowed association it is clear that these monuments of national life are supreme elements in that sacred thing which is the shrine of patriotism. A noble and ancient church, a university of proud and historic lineage, a town of honourable tradition contain in their bricks and mortar, in their very stones and timbers, values which are certainly no less sacred than the hills and valleys, the soil and the streams of a Fatherland.

When, therefore, an enemy effects any wanton or unnecessary damage on buildings of these kinds he is committing an outrage of manifold iniquity.

Assuming the necessity of war, each combatant has the right to inflict death on those brave men who fought for the defence of what they hold dearer than life. But the enemy who outside the exigencies of war wrecks the buildings that are the pride of his adversaries' land is dishonouring the very laws of combat. He takes from his foe not merely the life so willingly sacrificed, but the very things for which that sacrifice is made.

Heroes fight for their country. By their country we mean the continuity of their race, the honour of their women, the safety of their aged and their young, their native soil, their national possessions. The merchandise of war is life and blood, and the trafficker in that horrible market who reaches out impious hands to take toll in more than wounds and death is breaking the rules of war's compact of murder. The foe stakes his life. To rob an honourable foe of more than life, save in the settlement that follows capitulation, is to take from war its last justification.

And so for Louvain, for Reims, as for wasted fields and desolated innocence, we mourn with a lamentation that is righteous. The very dead call out to us to do so.

"Business as Usual" in Practice

MESSRS. Veritys, Limited, electrical providers and manufacturers, of London, are a first-rate example of an enterprising English firm that takes the trouble to let its overseas customers know that their requirements may be filled promptly and satisfactorily. Here is an extract from a letter which we received from them last week:—

> "Our factories are working as usual; deliveries are normal, and we are experiencing no difficulty in obtaining supplies of raw material. Prices have not been altered and there is no reason why business should not be conducted as usual. To cope with the extended business which will undoubtedly result we have already taken steps to increase our factory accommodation, adding three new bays to our works."

Here is a firm which gets right after new business in the very teeth of depression and seizes upon new opportunities with such success that while millions of men across the narrow strip of the English Channel are engaged in the world's greatest war, it finds the extension of its plant essential. The example is one to be upheld throughout the length and breadth of the Empire; for it may be asserted safely that devotion to business is as much the complement of military enterprise as watching is of praying.

It is stated that 600 cities in the United States are using hypochlorite of lime for water sterilization, and that no city following a proper procedure has found it necessary to discontinue its use. In a paper by C. A. Jennings, read before the Illinois Water Supply Association, statistics were presented to show that hypochlorite treatment is now firmly established, as it has accomplished what its conservative advocates originally claimed for it. The selective action on germs of water-borne disease has been proved by bacteriological analyses and typhoid statistics over a period of nearly six years. Of the eight cities the maximum reduction, 72 per cent., was in Cleveland, and the minimum, 3[illegible] per cent., in Baltimore. The average was 51 per cent.

LETTERS

The Deposit Cheque

London, Eng., November 4, 1914.

Editor, Contract Record:

Sir,—I regret not to have been able to reply earlier to your correspondent, Mr. R. De L. French, whose letter appeared in your issue of September 16. Unfortunately, the postal departments (both here and in Canada) appear to have gone to pieces at the first shock, and I had the pleasure of receiving by the one post four successive weekly issues of your paper. They had, I understand, been hung up en route, and here clearly there seems a case for the postal authorities to deposit a very substantial cheque in order to ensure due performance of their contract. This is such a "radical" suggestion that I still "hesitate to use my own name." We are under a sort of quasi-semi-demi-martial law here (at least as regards beer and brilliance) and I might be taken out and shot, or given forty-eight hours in the clink (to use a military term) in the morning.

Mr. French does not advance his argument by assuming that "the moral tone of the English contracting world is so high that a deposit cheque is not required." I know that this is "writ sarcastic"; but I will take him seriously and hasten to assure him that trade morality is no higher (or no lower) in England than it is in Canada or anywhere else. In the expression "business is business" may be summed up the world's trading morality. Whatever may be said, contracts are daily executed in England without resort to the deposit cheque system, and there has not as yet been any movement among English contractors to introduce it. If the Canadian or United States contractor doesn't object to weighing out, by all means let him; but it is incorrect to say that the deposit of a cheque is a "necessary formality." It is quite unnecessary.

"Failure to execute a contract does not," says Mr. French, "necessarily mean the forfeiture of the cheque." I must confess I was somewhat staggered when I read this, but Mr. French hastens to reassure me that I was about right in my radical attack. Sometimes the balance is returned," he adds, "after deducting the cost of a reletting, but more often a bidder is held responsible up to the amount of his cheque, for any difference in cost between the original tender and the price at which the work is finally awarded." I fear that there wouldn't be much of the cheque to return in the majority of cases.

On one point I sit corrected, and accept the statement of Mr. French, to whose experience of Canadian contracts I can lay no claim. He is in agreement with me when he says that " the deposit cheque will be returned to the bidder upon the execution of the contract," although he should have said the "satisfactory execution," or rather perhaps, "the execution to the satisfaction of the engineer," which may not be quite the same thing. He adds that "if the contract be not awarded within a specified time" the deposit cheque will be returned, and this certainly knocks the bottom out of the one point (although not the most vital by far) of my argument.

Mr. French gives his whole case away when he says "as long as human nature is what it is . . . . a deposit cheque or bidder's bond . . . . " A bidder's bond, certainly. It is the rule here, in the case of important contracts, for the contractor to obtain two bondsmen for due performance; but that is not quite the same as the deposit of a cheque. An owner will think twice before commencing an action for non-performance. He need not think at all when he already has the damages in his bank. On the contractor would fall the onus of taking action.

The best and only way "to protect a client against the loss of time and money" is to get a good contractor and to see that he is paid a fair price for his work. To bind a man down to a low price is bad engineering, and whether a cheque has been deposited or not doesn't alter the fact. Never once in my private experience have I attempted to coerce a man into standing by his tender, and in my public experience I have been able to bring the bodies I have served round to my way of thinking. It is, I am convinced, both the sensible and the honorable course to allow contractors at the foot of the list to withdraw their tenders. To make them stand to them is to court dispute, litigation, delay and scamping.

Yours faithfully,

"An English Reader."

The Proper Use of the Technical Journal

HELPFUL suggestions as to the reading of the technical journal and the manner in which articles of special interest may be filed and indexed, are given by Mr. J. W. Alvord in an interesting paper presented recently before the Federation of Trade Press Associations. At the outset Mr. Alvord observes that technical papers, constituting as they do practically the whole interchange of experience, form the repository of the profession.

With the rapid increase in and specialization of technical knowledge, engineering literature also has had to specialize, divide and concentrate. The problem of the engineer to-day in relation to his reading is to sort out, discard and eliminate that which he cannot use, and limit himself to the inspection and reading of that which bears principally on his selected professional specialty.

That we cannot keep abreast of the times without reading the technical journals is obvious. That if we carefully read all the technical journals in our chosen specialties we would have no time left to earn a living is easily capable of demonstration. The problem confronting the engineer is how to obtain the greatest good from this ever-increasing flood of information. Some engineers confine themselves to one paper, others take all they can afford; some carefully bind and shelve their copies, still others read what they can and then throw them away. As a rule, however, the engineer prizes his technical paper and endeavors in some ill-defined and formless sort of fashion to preserve its information for future use. The problem affects each engineer differently, according to his age, station and aim in life. To the man whose aim is only to get money and more money, the technical journal is a newspaper in which he may notice mainly where there are better jobs than his own to be obtained. To the man who is anxious to fit himself every year for something better, there is an opportunity for a great variety of study. To the young engineer it is, if properly read and noted, a part of his post-graduate course in engineering; to the middle-aged man it is a mine of data bearing in all sorts of ways on his work.

It is safe to say that to the young engineer and college graduate, engineering lireature will never have any proper perspective until he has been connected in some capacity with engineering work, be it ever so modest a capacity. With the actual doing of engineering work, however, should come co-temporaneously the reading of technical journals, particularly along the lines in which he is working. Nothing can be more instructive, broadening and enlightening to a man doing a particular kind of work than reading at the same time about similar work.

It follows therefore that the young engineer should, as early as possible, take at least one first-class engineering journal and own it himself; bind it if he can afford to, but in any event lay it away in an orderly manner. If one might advise, it would be to suggest enforced systematic reading of all articles particularly bearing on the line of work a reader is immediately engaged upon, and the optional reading only of such other articles as interest him. Some engineers are omnivorous readers by instinct, but it is to be doubted if laborious reading of all kinds of engineering articles all the time is advisable for anyone.

The matter of indexing is an especially difficult one for the young engineer to solve. It is probably not wise for him to indulge extensively in card indexes, filing systems and the like for topically arranging his valuable technical articles. Few men know very early in life where fate and interest will land their future attention, and filing systems and special indexes, which are expensive and time-consuming, when indulged in without definite aim nearly always quickly become too voluminous and thereby useless. If any suggestions are made along this line, it would be to start a loose-leaf notebook, letter size (8½ inches by 11 inches), and note in it (with separate pages for separate subjects) only what appears to be extremely useful, either in exceedingly brief abstracts from articles, or diagrams, costs, etc. These notes will be most useful if they are confined to that kind of work in which the compiler is immediately engaged, or at the most, work very similar to his own which has perhaps had his personal inspection.

The young engineer is tempted to read much about large enterprises—the Panama Canal, big bridges, astonishing tunnels, great dams, etc. This does no harm and probably holds his interest for the time being, but he gradually learns that, for him at least, the chief value of the technical journal does not lie in its dramatic side, necessary as that may be for our general information, interest and pleasure, but its chief value lies in a fund of small things which make up the routine work of the ordinary average job. These are to be watched for and noted, as practically useful to the average man.

For the man in early middle life, actively engaged in his profession, the problem with respect to the technical journal is the absence of time. There is much repetition in engineering writing and in the production of engineering papers, but each new generation needs the same drill in its reading as did its predecessors.

and each year a vast number of engineers have arrived at that degree of maturity that they will be interested to read matter that constantly impresses them and seems to them new, but which in reality has already been largely well written long ago. The mature engineer will note that a large amount of technical literature is of the purely descriptive order, merely giving an outline of work that has been accomplished, without going into reasons or principles. Such reading is valuable and useful, but has its limitations. But this class of engineer will find a great deal of material available to himself, and the question arises what he shall do with material which he selects as important to him.

Several courses are open to him: First, he may rely on his memory and the published index to his bound volumes. It is probable, however, that few engineers make practical use of this method. Second, he may keep a special card index of important data and reference to valuable articles. This involves labor and attention which few busy men can give and which, if done by assistants or librarians, largely loses its personal value to the one who needs it. There is an objection to volume indexes that the bother of the search is so discouraging that it is abandoned in about one-half the suggested attempts. It is probably safe to say that of all the contrivances for indexing, the most difficult to handle readily and examine rapidly is the card index system. Third, he may abstract important data in a limited way on loose-leaf transparent paper, standard letter size, and he may remove or detach articles of special value from out his journals, to be filed in regular office file systems like correspondence.

The writer has tried all of the above methods at considerable cost in time and patience, and has for many years settled upon the third method above outlined. With all its admitted limitations, it seems to be the best for an office which is expected to find out information on a great variety of subjects in a limited time and with the least amount of effort. Some descriptions of its practical workings may be of interest here:

All the technical papers of the office pass on to the desk of the head of the office and are at least looked over (not read) by him. Articles important to his particular specialty are checked with pencil, and articles of especial interest are looked over with care and double checked. Once in a long while data important enough to go to the data file are noted. This is either especially abstracted by the stenographer, or, if a diagram or cost data, perhaps traced in the drafting room; all on transparent paper for copying purposes. Special data of this kind on 8½-inch by 11-inch sheets are filed on the office data file (a separate but common standard correspondence file). From the data file loose-leaf working notebooks are made up from blueprints for office or travel purposes. They are altered, refilled, amended and sorted back from time to time as needed to keep them of usable volume and usually up-to-date.

The technical journals, with checked articles, go to the office clerk or the stenographer at odd hours, or the librarian if one can be afforded, and the useful articles are removed by cutting them out with a ruler. They are folded, usually once, to standard size, with one edge lap left for binding, and are then filed in a subject-matter file, like current correspondence. The Dewey decimal system, especially arranged for the office, is used, but only as a general subject plan. When the file is full, portions of its contents, especially that which is most useful, are simply bound in plain pasteboard covers and placed in the library shelves, with titles. Such a book (or many books) would contain all the recent articles thought to be of special value on a given single subject. The remaining portion of the technical paper is thrown away, but in a large office, warranting the expense, duplicate bound copies can be kept as well, with the general published index as their key.

The objections to this system are, that it is too expensive for any but the most important offices doing specialized work; that the data accumulate too fast unless rigidly kept down to a minimum, and that it requires some personal attention of the head of the office, a competent assistant or a regular librarian employed for the purpose. The advantages are that it compels the office head to know all the time what is being published in current engineering literature, if only by inspection; that it removes all intervening indexes between the searcher and the final repository in bound volumes; that it keeps one's library usefully up-to-date on all lines in which he should be especially interested, and it is economical of final shelf room and cost.

Obviously, one should not start so elaborate a system as this unless he is fairly sure of the special line of engineering to which his life will be devoted. It is not to be recommended to the young man, but only to the mature man of early middle life when his work thoroughly indicates the necessity for it. It is, however, absolutely essential to the specialist. Not a few consulting engineers use this standardized system interchangeably, particularly the data file, thereby greatly increasing its usefulness to each other as a joint effort.

To the mature and experienced engineer of advancing years, the technical journal again becomes a technical newspaper of great personal interest and deep satisfaction. He is now chiefly interested in the human, personal and ethical side of the work, and he realizes that, though he may have seemed to others and even to himself to have been striving all these years for emolument, as a matter of fact, the deep and abiding motive of his life work has been the pleasures of being needed and the joy of being useful.

Detailed comparisons of the cost of hauling by teams and motor trucks, made by the Chicago Municipal Market Commission, indicate that with the former the cost is 17¾ cents per ton-mile, while with the latter the cost is only 11¼ cents. It is estimated that two-thirds of the time is spent in loading, unloading and traffic delays.

The cause of the cracking of reinforced concrete when the reinforcing material discharges current into the concrete has been found to be the formation of rust upon the anode. In the report of the Committee on Electrolysis at the Atlantic City Convention of the International Association of Municipal Electricians, Mr. Jason Taylor, the chairman, stated, on the authority of the Bureau of Standards, that this formation of rust takes place only at temperatures around 100 deg. Fahr., and that damage to the concrete is therefore not to be expected unless the density of the discharge is very high, or some other conditions keep the concrete above the critical temperature. The addition of a fraction of 1 per cent. of salt to concrete increases its conductivity and destroys the passivity of the iron.

Suggested Design in Reinforced Concrete for Proposed Bloor Street Viaduct, Toronto

THE growth of the suburbs of the city of Toronto has created an urgent need for the development of transportation facilities across the Don River valley. This requirement is catered for by the linking of Bloor street with Danforth avenue by a viaduct which will accommodate the traffic of the northern portion of the city, avoiding a considerable detour and at the same time relieving congestion on the Queen and Gerrard street bridges, which take care of the traffic of the southern part of the city adjacent to the waterfront.

The project calls for the construction of two bridges, one approximately 1,600 ft. long, and another approximately 700 ft. long. The remainder of the work consists of grading the hillside. Tenders have been called for the construction of both bridges.

The character of the development of the district adjacent to this viaduct is a matter of great importance to the city, as the location forms a very desirable site for high-class residences. The adjoining district of Rosedale is occupied entirely by this type of residence and ranks high among the best residential districts of Toronto.

In such a district it is essential that the architectural features of the structure be given the closest consideration, as the expenditure of a fair sum of money in this direction will make many thousands of dollars' difference to the value of adjacent property and a proportionate difference to the city's revenue from that property.

There appears to be inadequate knowledge among engineers and the general public as to the development of reinforced concrete construction, especially relating to bridges

It is of interest to note that to the designs of one firm alone, 1744 bridges have been built over a period from the year 1895 to the year 1912.

Year	No. of Hennebique bridges erected
[illegible]	3
[illegible]	8
[illegible]	11
[illegible]	24
[illegible]	41
[illegible]	55
[illegible]	64
[illegible]	84
[illegible]	96
[illegible]	106
[illegible]	132
[illegible]	178
[illegible]	168
[illegible]	149
[illegible]	160
[illegible]	172
[illegible]	168
[illegible]	122
Grand total to end of 1912	1,744

These returns show clearly that there is no foundation for the idea that reinforced concrete bridge construction is still in an experimental stage. Moreover, considering for instance one bridge, the tests given below prove that the designers have achieved a high state of development and efficiency.

The Risorgimento Bridge over the Tiber at Rome was completed on the Hennebique system of ferro-concrete construction in May, 1911, and is now about three and one-half years old. It is 328 ft. clear span, 65 ft. wide over all, carrying ordinary roadway traffic and double electric car tracks. This is the longest span ferro-concrete bridge in the world.

Preliminary tests were conducted in April, 1911, with the following loads:—

Rolling load, 168 tons, consisting of seven steam rollers and a large tree trunk on a special wagon drawn by sixteen horses. This was an exhibit at the International Exhibition at Rome.

Deflection was as follows:—

	DEFLECTION		Proportion of Span.
	in Millimetres	Approx. equiv in inches	
Crown of Arch . . .	3·5	9/64 ths	1/28,600

Official tests conducted May 8-11 under the supervision of a special commission, consisting of Commander-Engineer Ceradini, Director of the School of Engineers, Rome; Cavalier Guidi, Professor of the Course of Construction of the Polytechnic School, Turin; and Commander Engineer Rinaldi, Assistant Director of the Italian State Railways.

Test (a) One-half of the bridge (crown to springing) was loaded to 127 lbs. per square foot with deflection as follows:—

	DEFLECTION		Proportion of Span
(mean of three instruments)	in Millimetres	Approx equiv. in inches	
Crown of Arch	13·1	33/64 ths.	1/7,634
Right hand haunch ...	1·00	3/64 ths.	
Left hand haunch. ...	13·7	35/64 ths.	

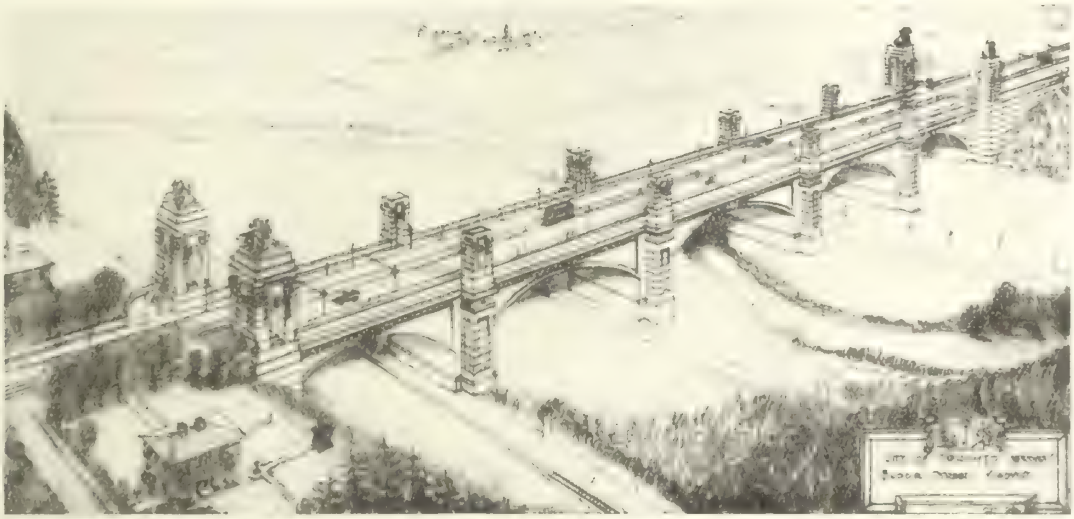
Test (b). The complete area of the bridge was loaded to 127 lbs. per square foot, the total load applied being approximately 1,370 tons.

Deflection was as follows:—

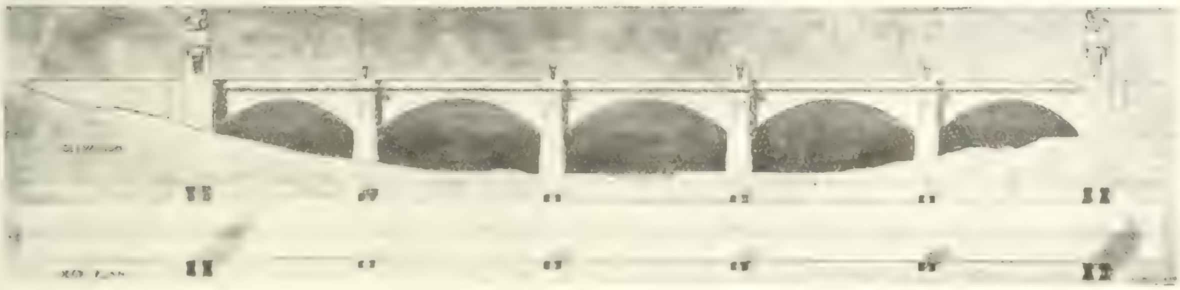
	DEFLECTION		Proportion of Span
	in Millimetres	Approx equiv. in inches	
Crown of Arch. ...	32·2	1 17/64 ths	1/3,105
Right hand haunch ...	16·2	41/64 ths	
Left hand haunch. ...	19·1	3/4	

Test (c). Load of 127 lbs. per square foot retained on footpaths, and bridge traversed by three steam rollers abreast (total weight approximately 52 tons).

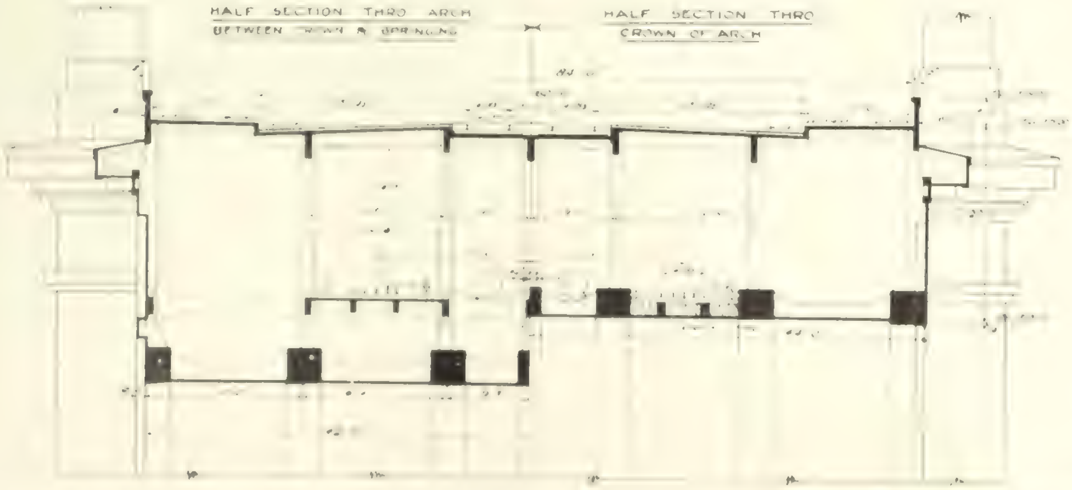
These road rollers were driven four times across the bridge in each direction, the instruments giving consistent diagrams, demonstrating the absolute elasticity of the construction and showing clearly the ab-



Perspective view looking from location North-East of the site.



True elevation and plan of viaduct drawn to scale showing architectural treatment.



Cross-section of the viaduct showing elevation of pier and sections through the arches at crown and midway between crown and springings.

Suggested Design in Reinforced Concrete for the Proposed Bloor Street Viaduct, Toronto

sence of permanent deformation. The maximum deflections registered were as follows:—

	DEFLECTION		Proportion of Span
	in Millimetres	Approx. equiv. in inches.	
Crown of arch ...	2·0	$\frac{5}{64}$ ins	$\frac{1}{50,000}$
[illegible]	0·9	$\frac{3}{64}$ ins	

Test (d). Vibration tests were conducted on July 14, 1911. Companies of soldiers were marched across, the pace being increased until the maximum vibrations were obtained. With 1,100 men marching at "quick step" the maximum deflection registered at crown of arch was 2 millimetres, = approximately 5/64ths of an inch, = 1/50,000 of the span. For the same number crossing the bridge at "the double" the maximum deflection was 2.5 millimetres, = approx. 7/64ths of an inch, = 1/40,000 of the span.

These figures are so striking that no comment is necessary.

Differences of temperature have much less effect on reinforced concrete construction than on a steel structure. It appears that the co-efficient of conductivity of steel is about thirty-three times that of reinforced concrete.

Reinforced concrete bridges have been constructed all over the world and have proved themselves capable of withstanding the severest climatic conditions.

We illustrate herewith the designs of Messrs. L. G. Mouchel & Partners, Limited (Hennebique Ferro-Concrete), for the Bloor Street Viaduct, Toronto. The contractors tendering on these designs were Messrs. William Cowlin & Sons, Toronto.

These views show fully the adaptability of reinforced concrete to the surroundings and the way in which it lends itself to architectural treatment.

The interesting feature of this design is that the subway tracks are entirely enclosed, reducing the effect of climatic conditions to a minimum. No snow or ice can lodge in the structure to add to the dead weight. The tracks, wiring, water and gas mains, etc., are housed within the structure and are readily accessible and protected.

Paints for Cement and Concrete Surfaces

Specially Contributed by H. B. Magowan

THE great number of uses to which Portland cement has been adapted in recent years, has created a persistent demand for paints suitable for decorating and waterproofing cement. The other methods involve the external application of substances to the cement after the manner of paints. The difficulty is to find a standard paint that will be suitable for all kinds of cement work, and at the same time be durable. If all cements were of the same chemical composition the problem could be easily solved, since the durability of the paint would be governed only by external conditions, such as moisture, smoke, salt, chemical fumes, and other atmospheric impurities. The chemical composition of cement, however, is by no means a constant factor, and the limitless variations in the physical and chemical constitution of cement mixtures, renders the standardization of cement paints almost impossible.

In order to understand the difficulty that faces the would-be painter of cement, it is necessary to know something of the chemical action that takes place when cement sets. The exact composition of Portland cement has not yet been determined, and consequently the reactions that take place when water is mixed with it can only be surmised.

Many researches have been undertaken to determine what takes place in the setting of cement, and whilst authorities differ on the subject, they are all agreed that Calcium Hydroxide is one of the resultant compounds.

The experiments conducted by the Russian chemist Liamin tend to show that calcium hydroxide to the extent of 3.2 per cent. is present in a crystalline state in cement seven days old. At the end of one year the same investigator found that the percentage of hydrated lime had increased to 32 per cent. These facts have a most important bearing upon the subject of cement paints.

The presence of lime in the cement is a disturbing factor in the durability of oil paints, for lime reacts upon the various oleaginous constituents; saponifying them, and forming a soap that is largely instrumental in hastening the distintegration of the pigments.

In order to combat the sponification of oils in paint a preliminary treatment, with the object of neutralizing the activity of the lime, has been tried out, with very successful results. One of the best-known of these treatments was suggested by Macnichol, and consists in the application of a 25 per cent. solution of zinc sulphate as an undercoat to the paint. When zinc sulphate is applied to cement chemical changes occur resulting in the formation of two inert substances, calcium sulphate and zinc hydroxide. The lime being now "killed" it is safe to apply good oil paints without fear of non-durability.

It is also claimed for the Macnichol process that cement can be successfully painted before it is thoroughly dried out, but such procedure would appear unwise.

Probably zinc oxide ground in pure linseed oil is the best single pigment paint that can be applied to cement, especially where the cement is exposed to the smoke of towns. The formation of sulphides causes the gradual blackening of lead paints, but since the sulphide of zinc is white the change from oxide to sulphide is not apparent.

In the North of Ireland, cement-coated houses are numerous, and experience has taught the owners that the best way to treat the exterior walls is to let them thoroughly dry out, before applying any protective materials. When once dry the cement is painted with pure boiled linseed oil, which darkens the appearance very considerably, but this dark appearance passes off in a short time. This preliminary treatment with oil serves two purposes: it renders the walls impervious to the moisture so prevalent in Ireland, and it neutralizes the lime. After one or two years the cement is in excellent condition for painting and two coats of good paint have been known to last many years without showing any lack of durability.

In Larne, Ireland, many of the better class houses are painted with red oxide of iron paint and the results have been most satisfactory, in some instances the paint appeared as good as new after years of exposure.

Many patent paints have been marketed with great promise of success, but the ideal paint has yet to be brought forward. Some of these paints contain resin, which is durable but unsatisfactory on account of its brittle nature.

Liquid hydrocarbons have been tried as a means of waterproofing cement, but the thin film of paraffin that covers the surface is not calculated to permanently resist the influence of moisture. Coal tar, asphaltum in solution, and various forms of pitch are utilized in other methods, but these substances, like resin, are too brittle and inelastic, and consequently very often fail to prove durable and weather-resisting.

One of the best suggestions advanced to protect cement from the elements is based upon the fact that the fatty materials in soap enter into chemical combination with the calcium hydroxide, forming calcium stearate, a waterproof compound.

In the Sylvester process the cement is treated with alternate coats of alum in solution, and soap. As the result of this treatment two compounds are formed—calcium stearate and aluminum hydroxide, both of which are capable of resisting water.

Attempts have also been made to utilize casein but it is entirely unsuited for the purpose, it being porous and apt to decompose in the presence of moisture.

Soluble silicates, such as sodium silicate (water glass) form the bases of other waterproofing compounds, the efficiency of these substances being due to the formation of mono silicate of sodium, a gelatinous precipitate that fills the surface irregularities of the cement.

The tendency of all recent research in cement work is to establish the fact that the best results in the painting of cement and concrete surfaces are obtained by the application of a priming coat of some efficient neutralizing agent such as zinc sulphate.

Individual experiments have sometimes led the builder to believe that paint will be quite permanent on dry cement without any preliminary treatment.

It is a simple precaution, however, to treat the surface with a solution of sulphate of zinc and it is better to be penny wise than pound foolish.

The Wielder of the Weapon

BREAKING away from the usual technical subjects, Prof. H. E. T. Haultain, of Toronto University, on November 5 read a paper, "The Wielder of the Weapon," at the monthly meeting of the Canadian Society of Civil Engineers, Montreal. This dealt with the status of the engineer, his relation to the public, and the need for more publicity as a means of raising the status. Professor Haultain contrasted the position of other professional men, such as lawyers and doctors, with that of the engineer, the former being more in the public eye by reason of the nature of their work. To-day the engineer was forcing the conveniences of man from nature. His weapons were science, and the wielding was his own, but he was so engrossed in his work of getting results that the public valued the outcome without recognizing the man who brought them forth.

This modesty of the engineers, Prof. Haultain said, extended even to their speech and dress. The engineer talked in blue prints and specifications, while his dress was fitted for hard work rather than for telling the public what sort of a man he was. The law had its spectacular trappings and oratory, while soldiers advertised themselves with gold lace, feathers and uniforms. But the engineers, who were doing much more useful constructive work, had no such means of advertising.

As to publicity, he admitted that this was a difficult matter, but argued that a paper publicity, which would educate the public to a better appreciation of the engineer, would be a great help to the younger men entering the profession. The real problem was to find suitable publicity. As one means he suggested the passing of legislation compelling municipal engineering work to be done by engineers of a certain standing, while the publication of a code of ethics might aid.

In this matter, he said, they must emphasize the man, the wielder of the weapon, who did not use the products of science for exhibition purposes, but turned them to practical use. The men who could do this were as worthy of high places as the men who could make the weapons, no matter how beautiful they might be. This wielding of the weapon of science, as applied to the needs of mankind, was so new and growing so rapidly that no one had a comprehensive view of it, and he left it with his auditors whether the engineer did not need some higher approval from his fellow-men.

In the discussion which followed, there was almost unanimous approval of the views of Prof. Haultain. It was pointed out that this was a very old subject, but none the less it was of great importance to the profession.

The President, Mr. M. J. Butler, emphasized the point that engineers did not occupy the position in the public eye that they were entitled to, and it was, he felt, largely their own fault. Men had been striving after the dollar, but as the result of this war it was probable that better ideals would prevail in the near future.

Mr. W. J. Francis spoke of the indignities that some of their members had suffered at the hands of municipalities, and suggested that this subject might be taken up by the Society. Mr. Francis alluded to the practice of many young men fresh from college setting up as consulting engineers, a practice which he believed was detrimental to the profession. He also condemned the idea of engineers competing for work, and alluded with approval to a circular issued by the Institute of Civil Engineers, London, strongly objecting to this method of employing engineers.

Mr. Julian C. Smith said that engineers should discuss Government and municipal schemes before these schemes were put into operation. He believed that this would be to the advantage of the public. Many engineers were employed by corporations, and from the nature of their work it was inevitable that these engineers should not be largely before the public.

Messrs. R. A. Ross, C. A. Fraser, J. Fairbairn, R. F. Uniacke, and Dr. Porter also took part in the discussion.

The spandrel or face walls of a concrete arch may be carried up at the same time as the arch ring is laid, or may be connected with it later by leaving short lengths of steel projecting radially from the concrete of the arch. Some engineers require that arch centering shall be lowered sufficiently to allow the arch ring to assume its permanent set before parapet walls are placed.

The Functions of a Municipal Engineer[*]

The More Important Duties Outlined, Particularly in Reference to Water-Works Engineering—Use of Reinforced Concrete in Reservoir Construction

By Prof. E. R. Matthews[†]

NO branch of engineering is more important than that connected with municipal work, and the position of engineer to a corporation is becoming more responsible every year. I believe the time is fast approaching when the municipal engineer will be an official who will reap the advantages of a pension, and who will be given "security of tenure" by the Government. On the other hand, the time has arrived when no one should be allowed to hold an appointment as municipal engineer to a corporation (who has not hitherto done so) unless he can show that he has had a theoretical training as well as practical experience.

Chief Duties of a Municipality

Whether coast or inland town, the chief duties of a municipality are:—

(1) To supply pure water for the use of its inhabitants.

(2) To provide a proper sewerage system with sewage disposal works.

(3) To construct suitable streets and highways, and to maintain these.

(4) In many towns to put down and maintain a tramway system.

(5) To adopt a proper method of collecting and disposing of house refuse.

(6) To establish a satisfactory system of street lighting.

In addition to these and many other duties which he has to perform, the municipal engineer has now to prepare for his corporation town planning schemes, and in preparing these he must be able to look ahead, chiefly from an engineering point of view, and to anticipate the requirements of the town, say, twenty to thirty years hence. He will therefore have to be a man who dreams dreams and sees visions. But, in preparing a town planning scheme, I certainly think that he should work in conjunction with an architect, for, after all, town planning is more of an architectural matter than an engineering. The Institution of Municipal and County Engineers have recently decided to grant a certificate or diploma in "Town Planning," which is to be obtained by examination. This is a step in the right direction.

The introduction of reinforced concrete in engineering construction makes it very necessary that he shall be acquainted with this material, and understand how to calculate the strength of it under various conditions.

It is also extremely necessary that the municipal engineer should have a thorough knowledge of building construction, for while he must not claim to be an architect—for that is not his profession, and my experience has been that the man who is a good architect is a poor engineer—nevertheless, he will usually be responsible for the inspection of new buildings. He will often have to advise his council as to whether or not a rolled steel joist of a certain section will be sufficiently strong to carry a wall that is to rest upon it, or upon some other equally important point, and it will frequently happen that he will have to settle a dispute between an architect and a contractor relative to the strength of some part of a structure.

Chief Duties of Municipal Engineers

It will be quite impossible for us to deal with the manifold phases of a municipal engineer's work, which I have named. We will therefore confine our attention to the chief duties of a municipality as already set out, and discuss two or three matters which come under one or other of these heads.

"Scientific" Street Watering

That the ordinary humdrum task of street watering may be carried out scientifically may seem a somewhat remote possibility, but this is not so. It is painful to observe the waste of water and labor which occurs in the usual methods adopted in street watering. Take a concrete case. Here is an ordinary macadam road, 38 ft. wide. The water cart with its spreaders is able to water a width of road each time of, say, 16 ft. Assume that the old-fashioned spreaders are in use, which do not admit of one side being shut off and the other only in operation; the result is that, to water the road the full width of 38 ft., the water cart must pass over the road three times. But 16 x 3 equals 48, and all we require to water is 38 ft.; therefore 10 ft. of the road is watered needlessly. Water is thus wasted and labor, and the use of the horse, which might have been otherwise employed. The method I have adopted in watering a road, say, of that width, is to water the sides of the road, including the channels, and to leave the centre of the road. I find that the dust on a road does not accumulate in the centre, but blows towards the channels, and this is where the watering is needed. The centre strip of the road need not, indeed, be watered. The Westminster City Council, I notice, are using a very useful motor vehicle in the shape of a cylindrical water cart, which probably holds 1,000 or more gallons of water, and this vehicle flushes the channels of the road in a very rapid way. I advocate the use of such.

I now propose to deal briefly with another branch of municipal engineering—namely, waterworks engineering.

Use of Reinforced Concrete in Reservoir Construction

First let me set out some of the advantages of using this material.

There is a growing tendency on the part of engineers, especially in America and on the Continent of Europe, to construct service reservoirs in reinforced concrete. A notable example of this may be quoted in the case of the new reservoir recently constructed at San Francisco. Mr. Shaughnessy, the city engineer of San Francisco, has—wisely, I think—used reinforced concrete in the construction of this reservoir. The advantages of using this material for this purpose are many:—

(a) There is a saving in first cost.

(b) A reservoir built in this material occupies less space than one constructed in masonry or brickwork, or a combination of both.

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[*] Abstract of an Address delivered at University College, London.

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(c) It can more easily be made watertight.

(d) It increases in strength with age.

(e) There is less likely to be vegetation upon the face of the walls.

(f) Practically no cost in maintenance.

Circular vs Rectangular Reservoirs

In the United States most of the modern reservoirs are circular in plan. Reservoirs of this shape are seldom constructed in this country, British engineers preferring a rectangular structure. I recommend the circular shape, the chief advantage being that when of this shape no angles occur, so that the reservoir wall can be built without a joint. This is a great advantage, for one often finds that when leakage occurs in a reservoir it can be traced to the point where the walls join. Circular reservoirs, because of their circular form, are also better adapted to withstand external earth pressure; they are cheaper than rectangular ones.

The San Francisco new reservoir previously referred to is a good illustration of the circular type of reservoir. This may be briefly described as follows:—

The reservoir was completed about two years ago. It is known as the "Twin Peaks" reservoir, and is a good example of what may be done in reinforced concrete. It is oval in plan, and divided into two parts by a reinforced-concrete dam. The reservoir is situated 750 ft. above the business section of the city, and is part of the high-pressure system for fire-extinguishing purposes established in consequence of the terrible fire of 1906. The dimensions of this reservoir are 370 ft. by 25 ft. 8 in. area, and the depth of water allowed for is 27 ft., or a capacity of 11,000,000 gallons. The buttresses of the dam are spaced at 9-ft. centres on both sides of the wall. They are 1 ft. in thickness, and 13 ft. wide at the base.

Watertight Reservoirs

Referring to the leakage of reservoirs, we would say that this is a problem which has engaged the serious attention of engineers for many years past. Reservoirs have been constructed in what appeared to be a substantial manner, on a good foundation, and at a cost of many thousands of pounds, but they have never ceased to leak, and while many attempts at remedying the leakage have been made, these constructions are looked upon, from an engineering point of view, as a failure.

I know of no type of reservoir, however, which is more likely to be watertight than that constructed of reinforced concrete, provided the reservoir is properly constructed and expansion joints are inserted in suitable positions both in the walls and floor of the reservoir, and if suitable material is used for the concrete, and the walls are not less than a minimum thickness of 5 in., and are well reinforced, and that the depth of water in the reservoir does not exceed, say, 30 ft.

The thickness of the floor will depend entirely upon the sub-foundation. This floor may be either of plain or reinforced concrete; if the latter and the sub-foundation is good, the thickness of floor should not be less than 6 in. for a depth of water up to 15 ft., and 9 in. for a depth ranging from 15 ft. to 25 ft., and 12 in. from 25 ft. to, say, 35 ft. In every case it is assumed that the floor is well reinforced. In order that the reservoir may be watertight, in addition to the before-named precautions, great care must be taken as to the properties used in the concrete. I would suggest that never should a weaker mixture be used than 1:2:4, and where the depth of water to be stored is not less than, say, 20 ft., I would recommend a mixture of 1:1½:3. The materials should be very carefully graded, as most of the trouble in reservoir work occurs where this has been imperfectly done.

I also recommend for reservoir work that a wet mixture shall always be used, and while a dry mixture may show a better result as regards its strength in compression, and a plastic mixture may also give better results in this way, still a wet mixture more perfectly prevents leakage, and on that account should always be used.

Not only so, but with a wet mixture the reinforcement is better covered. I have seen reinforced-concrete work where a fairly dry mixture had been used, and where occasion had arisen for the breaking up of the concrete, where the reinforcement in places had not been covered in the least degree by the concrete. This had occurred, first, because the mixture was too dry, and, secondly, because the aggregate used was too large. In practice the concrete should be of such a consistency that every portion of the reinforcement will be well covered, and every crevice filled.

Not only is this obtained by using a wet mixture, but with such a mixture when the forms are removed there is a smooth face to the concrete, and on this account also it is wise that the mixture should be fairly wet. Care, however, must be taken to see that it is not too wet. It is possible for too large a quantity of water to be added so that the grout will run through the joints in the forms, and escape from the wall; on no account should this occur. If reservoir walls are constructed with a mixture of 1:2:4, the ultimate strength of this concrete, assuming well-graded stone and sharp sand is used as the aggregate, will be about 2,000 lb./in.^{2} at the termination of one month, and 2,700 lb./in.^{2} at the end of six months. The usual working stress for good concrete is taken at 600 lb./in.^{2}. Under exceptional circumstances, however, this may be reduced to, say, 500 lb./in.^{2}, but I would recommend, generally speaking, for reservoir work 600 lb./in.^{2}.

Reservoir Piers

These are sometimes built circular in plan, and there is a slight saving in the space occupied by so doing. It is, however, more costly to construct the forms in this shape, and the advantage of saving in space does not really compensate for the increased cost. The usual practice in this country is to build rectangular piers, and to chamfer the edges, say, with a 1½-in. chamfer to a 10-in. or 12-in. square pier. The square pier has the advantage also that it affords a better seat for the reinforced-concrete beams carrying the roof to rest upon.

Reservoir Roofs

In reinforced-concrete reservoirs this usually consists of a reinforced-concrete slab, 5 in. or 6 in. in thickness, carried by reinforced-concrete beams which rest on the piers just referred to. Some engineers prefer a lighter slab, and to ensure this they introduce a system of secondary beams. For my own part I do not care for the roof slab to be of greater thickness than 6 in.; 5 in. is preferable, and the beams can be designed accordingly. In calculating the weight of the roof it is necessary to include the weight of concrete and reinforcement forming the beams and slabs, also to allow for any soil which may be spread on the roof. This is usually about 1 ft. or 18 in. in thickness, also to assume a thickness of snow of, say, 2 ft. It is necessary to construct two or three openings in the roof for the purpose of getting to the [illegible] of the reservoir, and iron ladders are usually built in at these points. The openings need not be larger than 6 ft. by 3 ft.

Cement Grouting

It is always advisable after short sections of the work have been completed to wash the walls over with two coats of cement grout, 1 to 1 (sand and cement). This fills in any slight cracks which may have occurred on the suface of the concrete. A fortnight should elapse before the grout is applied. No further cracks on the surface of the concrete will be likely to occur.

Wetting Concrete

If the reservoir is being built during the summer months, when the sun is likely to dry the surface of the concrete very rapidly, the latter should be frequently wetted so as to retard the drying action of the sun. It is also advisable to do this in high winds.

Size of Aggregate

In reservoir work the aggregate used in the construction of the walls, floor, piers and beams of the reservoir should be capable of passing through a ¾-in. ring; for the roof slabs it should be capable of passing through a ½-in. ring.

Where the thickness of the concrete floor exceeds 9 in. the aggregate should be capable of passing through a 1-in. ring, the upper 4 in. of the concrete in the floor should consist of concrete, the aggregate of which is capable of passing through a ¾-in. ring.

Reinforcement

It is not my intention to advocate any particular system of reinforcement. There are many in the market, and most of them are good, and I say this after having used several different systems myself. It is quite possible, however, and I strongly advise you to adopt this course, for the municipal engineer to work out his own stresses and design his own system of reinforcement.

Thickness of Walls

For heads up to 10 ft. a 5-in. wall will generally be found to be sufficient; a 4-in. will answer, but I prefer a minimum thickness of wall of 5 in. It has, however, been suggested that the walls should be increased in thickness for every additional 5 ft. increase in head of pressure. I agree with this suggestion, but prefer that the top 6 ft. of the reservoir wall shall be 5 in. in thickness, and that the wall shall be increased in thickness by 2 in. for every additional 6 ft. of its height.

It is usually desirable to build counterforts or buttresses at the back of the wall.

There is a saving of from 20 to 25 per cent. by using reinforced concrete in the construction of reservoirs. Some engineers recommend that the water face of reservoir walls shall be rendered with 1 to 1 cement mortar to a thickness of ½ in. or ¾ in., but I do not favor this; I think it is unnecessary.

Stresses

The elongation of steel being so much greater than that of concrete, it is advisable, in order to ensure of the reserevoir being watertight, to limit the stress to 12,000 lb./in.^{2}, and I think it is advisable in reservoir work to use bars which give a mechanical bond, such as the indented bar, twisted bar, lug bar, or one of the other various types of bars, rather than plain bars, but this only applies to reservoir work, as plain bars are admirable for all other reinforced concrete work.

It is necessary that an adequate percentage of steel be inserted in the concrete in both directions, even when the stresses due to water pressure occur in one direction only, or otherwise slight cracks may occur.

Reservoirs may be—

(a) Entirely sunk below ground.

(b) Partly sunk below ground.

(c) Out of ground.

(a) **Reservoirs sunk below ground.**—On designing the first type we must remember that the reservoir may be full or empty. When empty the walls will be acting as retaining walls with all the pressure at the back; when the reservoir is full there is still the pressure of the soil at the back of the walls, but counteracting this is the water pressure from within. It is therefore desirable that walls of this class shall have reinforcement on both sides, and not in the centre of the wall, as had the reservoir which failed at Mittagong, N.S.W., as we shall see presently when considering that failure.

(b) **Reservoir partly out of ground.**—These are known as the cantilever type. In determining the width of the heel we must remember that in an ordinary retaining wall the weight of the earth at the back of the wall would help to keep the wall from overturning, but with a reservoir the weight of the water should be disregarded. The heel should therefore be made of sufficient width and thickness to be stable when the weight of water above it is neglected. One of the most important things to be careful with in designing a reinforced-concrete reservoir is the arrangement of the bars at the joint between the vertical wall and the footing.

(c) Reservoirs out of ground.—These will be similar in design, but buttresses are usually added. The wall acts as a dam to withstand water pressure.

Reservoir Roof

This often acts as a tie, and holds the reservoir walls together; the reinforcement is therefore arranged accordingly. When the span is large, however, the elongation may be considerable, and it is then not advisable to tie the walls in this way, but to give the roof free sides for expansion.

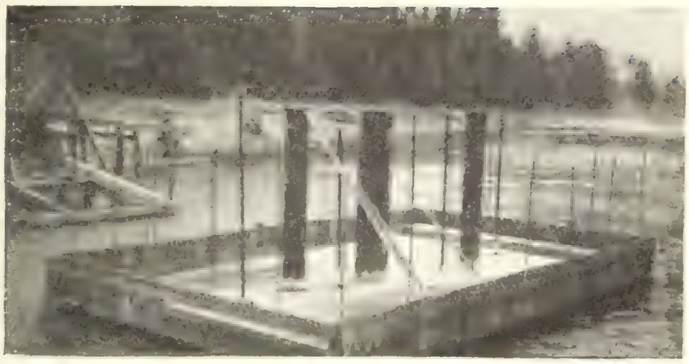
Engineers who are not in favor of the use of reinforced concrete are very ready to draw our attention to this failure; but this is unfair, for the reasons why the structure failed are quite clear, as we shall see in a moment.

We can always learn more from failures than from successes. This reservoir was 40 ft. diameter, and was built in connection with the water supply of Mittagong, N.S.W. It burst on January 22, 1909. It contained 32 ft. of water at the time of bursting. Once before it had been filled to a depth of 33 ft. 9 in. The reservoir was constructed on a solid rock foundation in an old quarry excavated 7 ft. deep on top of a steep hill, and when the structure burst the 240,000 gallons of water which it contained rushed down the slope; no damage was done, however. The lower half of the reservoir failed all round simultaneously; the upper half then collapsed.

The floor of the reservoir was 12 in. thick, and of plain concrete.

Design: Capacity of reservoir, 314,000 gallons; 40 ft. deep to top of water level; shell of reinforced concrete, 4½ in. thick under coping, 10½ in. thick at bottom of wall, including ½ in. of rendering on inner face, and ¼ in. on the outer surface.

Launching caisson No. 2, Fraser River Bridge.



Caisson No. 2 immediately after launching.

An Expeditious Bridge Contract in British Columbia

(Staff Article)

THERE was recently completed at Hope, B.C., for the Kettle Valley Railway Company, the substructure of a bridge across the Fraser River which on account of the rapidity of its construction merits somewhat, more than passing mention. The substructure consists of three river piers and two abutments, and the finished quantities of concrete amounted to 9,300 cubic yards. The river piers were put down by the pneumatic process, the caissons being of timber construction with steel cutting edges and of the following sizes: Pier number 1, 25 feet x 5 1feet 6 inches; piers numbers 2 and 3, 29 feet x 51 feet 6 inches. The cribs were of 12 x 12-inch timber throughout. Each caisson was equipped with two muck locks and one man lock. The shafts were roughly boxed in from about 10 feet above the deck of the caisson and recovered after sealing. The pier shafts were nine feet under the coping with uniform batter of 1 in 15, semicircular ends being struck from centres 28 feet 8 inches apart. The coping was three feet in depth. The superstructure will consist of four spans each 238 feet long with provision for a roadway above. Ground was broken in November, 1913, and the whole work was completed early the following May. About 160 workmen were employed on an average during the progress of operations. Following are details of the pier construction.

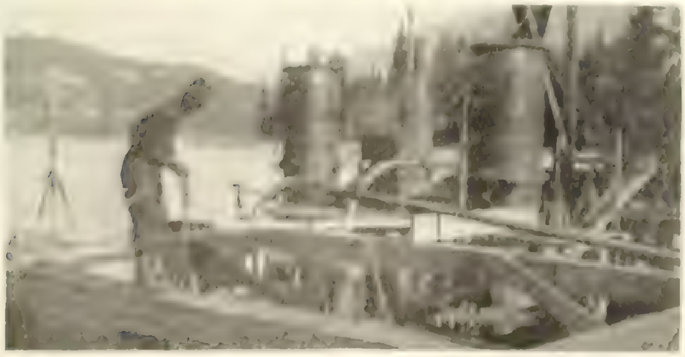
Number of pier	Depth of water	Penetration	Material	Average sinking per 24 hours
1	36 ft.	30 ft.	Gravel & Sand	1.74 ft.
2	[illegible] ft.	30 ft.	Gravel & Boulders	1.45 ft.
3	[illegible] ft.	8 ft.	[illegible]	[illegible] ft.

The compressor plant consisted of three 60 h.p. loco type boilers, two Canadian Rand compressors, 14-inch x 18-inch x 18-inch direct acting, with receivers for supplying air to the working chamber and one Ingersoll Sergeant compressor, 12 inch x 18 inch, high pressure for rivetting, boring, driving drift boats, etc. There were also a scow and overreach divers as well as two concrete mixers. The usual accompaniment of derricks, cars, etc., completed the plant.

Housing accommodation for the working force consisted of four bunk-houses each occupied by twenty-four workmen, one bunk-house accommodating fifteen men, an office and kitchen camp with dining room accommodation for one hundred men.

When it is considered that 300 feet of falsework was carried away by the ice, that delay was occasioned at pier number 2 by a strike of sandhogs, and that from April 5th, when the river began to rise, until the end of the work when the total rise exceeded 8 feet, considerably extending operations, the completion of the work before high water reflects great credit on the contractors, Messrs. Armstrong, Morrison & Company, of Vancouver. This work was under the direction of Mr. A. McCulloch, M. Can. Soc. C. E., Chief Engineer of the Kettle Valley Railway, with Mr. F. Pardoe Wilson, M. Can. Soc. C. E., as Resident Engineer in the field.

The annual meeting of the Canadian National Clay Products Association opens at the King Edward Hotel, Toronto, on January 26 next. The Secretary is Mr G. C. Keith, 32 Colborne Street, Toronto.



View of muck locks on caisson No. 3 showing arrangement of piping preparatory to the erection of working platform.

Fraser River Bridge. View from north-east at the completion of the work.

The Construction of the Canadian Northern Pacific Railway[*]

By J. V. Nimmo

FOR a railway passing through one of the main mountain regions of the world, the work is on the whole, extremely light. From Port Mann to Rosedale, mile 47, the grading is largely prairie work, although spurs from the main mountain range give rise to heavier work at intervals. From Rosedale to Hope, mile 77, the work becomes heavier as the valley narrows, and stil more so from Hope to Yale, mile 91, but so far there is nothing calling for special comment. At Yale, the canyon proper is entered, and the heaviest work on the whole railway is encountered, the heaviest mile cost $326,300, without fence, telegraph or track. From Yale to Boston Bar, a distance of 26 miles, the rock work is extremely heavy, and there are 15 rock tunnels, aggregating 8,321 ft. The rock is mostly granite, and bluff follows bluff, all with almost perpendicular faces. A great deal of this rock was shot into the river, but a surprising number of fills were successfully constructed. As the rock was largely in huge masses, partly owing to its rough nature, and partly owing to the fact that it was often separated into large blocks by natural seams, these fills are well calculated to stand even the Fraser floods. This piece of line was perhaps the most difficult one to locate and cross section.

Character and Incidents of Work

From Boston Bar eastwards, gravel is frequently encountered; indeed, from mile 128 to Savona, mile 218, there is almost more steam shovel work than anything else. The heaviest yardage is in the neighborhood of Tilton Creek, mile 130. Here cuttings aggregating 414,000 cu. yds., were led to one large fill. Jackass Mt., extending from mile 130 to 134.5, consists of massive conglomerate and shale; the yardage for this half mile was 182,000 cu. yds., with two tunnels aggregating 548 ft. One of these tunnels was, however, carried out in an enormous slide in the hill side on the night of November 18th, 1912, following a period of heavy rain about six weeks after the tunnel was finished. The formation through which the tunnel was driven was very broken. A large black shale seam about two feet wide, which made an angle of about twenty degrees with the vertical, and thirty degrees with the centre line of the tunnel, crossed the line of the tunnel about one-third way through from the east end, separating the country rock on the up-side from an overlying rock formation on the other. This overlying material was very broken, and interspersed with soft clay. It seemed to be debris from the mountain side above and bore no relation to the country rock. Whether the hill slid on the shale seam, or whether the clay, swollen by the heavy rains, exerted excessive pressure on the tunnel timbers causing them to collapse, thus releasing the toe of the hill, it is impossible to say. The whole slide had been removed, and the hill side dressed to an apparently safe slope, when three weeks later, on August 25th, 1913, another slide of considerable magnitude occurred. This was in turn removed, and the slope re-dressed, leaving now an open cutting, probably safer than any other part of the mountain. The line crosses the Fraser at Cisco to follow the north or left hand bank, thus avoiding the Canadian Pacific. It re-crosses again at Lytton, and three-quarters of a mile further on, crosses the mouth of the Thompson River, since it was considered less costly to build these two crossings, than one large one across the Fraser, above the mouth of the Thompson.

A piece of heavy work is met with at Gladwin's Bluffs at mile 149 to 151. This is a contact zone between the Coast Range Batholith and the Paleozoic schistose rocks, the whole traversed by many tertiary dykes and chonolithic intrusions. It is a particularly awkward place on which to locate. The quantities for this two miles of work are as follows:—478,946 cu. yds. of excavation and 990 lineal feet of tunnel. The average cost per mile is $222,650, without track, telegraph or fence. Just beyond the Gladwin Bluffs, the line is constructed along the top of a rock cliff and at the foot of immense gravel slopes, which rise at an angle of between 1¼ and 1½ to 1, to a height of some 700 feet. This gravel, which was well cemented, was excavated by the hydraulic method, excess roadbed width being allowed, depending on the height of the face. The faces have stood splendidly, although the debris naturally accumulates at the foot of the slope, but not to a greater extent than such maintenance forces as must necessarily be employed by a railway through such mountainous country will be able to cope with. Bad bluffs were encountered at Thompson and Drynoch.

The rock at Thompson was even more broken than that at Gladwin, and a huge slide has occurred which is still being removed. At mile 162 there is a heavy clay slide, which is still moving, although 350,000 cu. yds. have been removed to date. There is no evidence of water seepage and there is nothing to do but keep on excavating, until the material reaches its angle of repose. Drynoch Bluff, mile 163, was a most dangerous place on which to locate, and offered the usual difficulties in construction. It has three short tunnels and the open slope is very high, surmounted by a good deal of gravel and other debris. Crib traps have been installed at various points on this slope to catch this debris, but here, as in other places, constant watch must be kept by the maintenance organization. At mile 184 the line crosses on to the C. P. R. side of the Thompson River and re-crosses at mile 188.5, passing direct from the bridge into a tunnel 1,319 feet long in the famous Black Canyon. This formation is a black cretaceous shale and sandstone. Just east of this tunnel there is a slide similar to the one on the C. P. R. side west of their Black Canyon. A spring, which made its appearance about one-third of the way down the slide, was tapped by a water tunel and led to an adjacent gully. At every high water, however, the slide moves and has moved for some one hundred and twenty feet since the records were first taken. It is thought that this is due partly to saturation from the melting snow, and partly from the action of the high water in the river, although what happens exactly is not yet understood. Borings showed 26 feet of clay and then gravel, but they were not taken down through the gravel. Some two miles further east the grade was first constructed at the foot of the bluff, partly in cut and partly in fill, the latter standing well until the flood of 1913. An extensive crib is now being constructed at this place. From Ashcroft, mile 194, to Savona, mile 218, it is almost all steam shovel work in glacial clay. Rock work is again encountered along Kamloops Lake, including a tunnel at Battle Bluffs 2,835 feet long. At mile 244, the line crosses to the east bank of the North Thompson; immediately east of the bridge is the Kamloops Division yard. Between Lytton and Kamloops there are three crossings and re-crossings of the Thompson River, to avoid heavy clay bluffs; the work on the Canadian Pacific side at these places being generally very light. From Kamloops Junction, mile 243, to Birch Island, mile 324, the work is easy on the whole, although occasionally the line hits a rock slope with some severity. From Birch Island to the third crossing of the Thompson River at mile 339, there is heavy steam shovel work along the supported grade. From mile 330 to the fourth crossing at mile 351, although the work was largely steam shovel material, it was entirely carried out by hand, owing to the difficulty of getting in machinery.

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[*] Transactions Canadian Society of Civil Engineers.

There is little to call for comment from here on, except to refer to the extraordinarily light work across Stillwater flats, until the supported grade between miles 360 and 376 (Canoe Landing) is reached. This is the heaviest portion of the North Thompson River work, particularly at Hell's Gate, where the river passes through a miniature Fraser Canyon, involving heavy rock cutting and two small tunnels. From mile 376 to the next supported grade at mile 406, the work is extraordinarily light for a mountain railway. From mile 406 to 417 extends a region of heavy sand, gravel and clay cuttings, and tunnels, one of these latter being 1,000 feet long. All this work is done by hand as it is not practicable to take in machinery. From mile 417 to the Albreda Summit the work is again very light, indeed at the summit itself it would be cheap for prairie country.

Crossing North Thompson River

The two crossings and re-crossings of the North Thompson are to avoid heavy work, and to get better alignment. The first two of these crossings are 80-foot deck plate girders, supported on pile piers, consisting of a group of 32 piles, capped by a three course grillage of 12 by 12 timbers. This in turn is topped by a one-inch steel plate bored to receive the anchor bolts from the girder bearings. Placed about the piling is a timber crib, pointed on the up stream and square on the other end. These cribs are not attached to the piling, but form a sleeve, and are sufficiently free of the piling to permit their sinking as they are built up from the water surface. The tops are completed to about five feet above high water and then are rock filled. The third crossing is a temporary pile bridge below the permanent crossing which will be of concrete piers. The other two crossings are low and short, and are over wooden pile bridges. From mile 425 to Canoe River Crossing at mile 436, the rock work is fairly heavy, although there are a good many gravel cuttings also. Canoe River is crossed on a steel viaduct. From this point to mile 445, the work would be light even on the prairies. No really heavy work is encountered until the Fraser Valley is entered at mile 453. From this point the Grand Trunk is paralleled and the two roads are never more than a few hundred yards apart.

From mile 456 to Moose Lake, mile 472, there are some very heavy rock cuttings. Difficulties were particularly great for the last ten of these miles, owing to the fact that the grade had to be constructed immediately above the Grand Trunk, then in operation. The two lines run on the north shore of Moose Lake side by side as double track. From Moose Lake the Grand Trunk falls with a one per cent., and the Canadian Northern with a seven-tenths compensated grade. Hence the two lines rapidly diverge in elevation but remain very close in alignment. All mucking over this portion, from the Canadian Northern had to be carried across the Grand Trunk on trestles and shot direct into the Fraser River. Six of these trestles and chutes were constructed. From Moose Lake to Yellowhead, the work calls for no special comment, as it is light, and the valley wide and uniform enough to provide an easy route for both railways.

There is not much in this work of interest to railway engineers, except, (1) the bridging; (2) the steam shovel work in gravel and clay, and the resulting slopes; (3) the rock blasting; (4) the classification. (1) With regard to steel bridges: As these were designed and entirely under the supervision of Messrs. Waddell & Harrington, consulting engineers, the author does not propose to make any reference to them, beyond showing some views, in the hope that a paper will be read some day before the Society by a member of Messrs. Waddell & Harrington's firm. (2) The steam shovel work in gravel and clay, and the resulting slopes. No one would deny the value of steam shovels, or their necessity, if such work as is now being described, is to be carried on economically and expeditiously. At the same time, the engineer would be delighted to dispense with them, were that possible, unless the material were being excavated to a final angle of repose. In some cases this was done, but speaking generally, such a plan is a counsel of perfection, and not economically practicable. The difference in yardage between 1:1 slopes and 1½: 1 slopes on side hills that extend upwards for hundreds of feet is self evident. Moreover, in most gravel cuttings, a 1:1 slope, if not permanent, would give very little trouble for a number of years, when it can be economically handled by steam shovels with main line equipment. But when 1:1 quantities are dug by steam shovel and the slopes left standing nearly plumb, it means that the company has frequently to face comparatively heavy further excavation expenditure after the line is opened. Sometimes a portion of the slopes in steam shovel work was lightened by having the top hand sloped; but in the more cemented gravels and harder clays, the slope was left as dug by the steam shovels.

Undoubtedly, all things being equal, unless the quantities to be excavated in the first instance are those contained by slopes at the angle of repose, hand slope work is infinitely more satisfactory than steam shovel work. Most of the gravel and clay lies in the dry belt, otherwise it may be supposed there would be little left. Hence the conditions on this construction were unusually favorable for the safety of undressed slopes. (3) One of the main difficulties the railway engineer encounters is to prevent the contractor from using too much powder. Such work as is here described is usually carried out by station-men working under sub, or sub-sub-contractors of the main contracting company. The stationman, who seems to live in a state of perpetual hope, is strongly tempted to overshoot, with a view to breaking up his rock as small as possible, and to save handling, where, as was largely the case on this work, the material was wasted direct into the river, whose course the railway is following. That this may result in over-break, the stationman is well aware; but his faith and hope in the engineer's charity, will induce him to chance the disallowing of the over-break. If allowed, he stands to gain heavily.

Besides, there are seams which with a little flattery and talk about the experience of the engineer, etc., etc., he may hope to pass off as the cause of the over-break. Indeed, the engineer will often be in a quandary to know whether the rock, even though lightly shot, would not have broken to a clearly indicated seam. The sub-contractor has little inducement to check the stationman from over-shooting for the more powder the stationman uses, the more profit the sub-contractor stands to make. If no more than the estimated yardage is paid for, the sub-contractor makes at least as much profit as he set out to make and if overbreak is included, he is that much to the good. Thus with blarney and bluster, pressure is brought to bear on the engineer on all sides, which it is frequently very hard to resist, especially by the younger members of the profession.

Our Society excludes in its Standard Specifications the use of powder in large blasts in seams, drifts, shafts and coyote holes. This again is merely a counsel of perfection, nor would its strict enforcement tend to economy. The remedy must always be in the judgment and experience of the engineer in charge, who should make a point of at once warning the contractor against the results of heavy shooting, as soon as he sees any signs of such a course being proceeded with, and hold him strictly to account if his warnings and instructions are neglected. From the experience of this work, the author is strengthened in his convictions that more than from a pound to a pound and a quarter of explosive to a cubic yard of excavation is needed only in very rare cases; and in ordinary sandstone and limestone, if at all seamed, three-quarters of a pound per yard would generally be sufficient. For shales, half a pound or less is plenty. (4) Classification. From Port Mann to Hope, and from Kamloops to the Yellowhead Pass, four classifications were used, in accordance with the Canadian Northern Standards, as to which no special comment is necessary except as to the definition of solid rock, which is the same through the whole work. From Hope to Kamloops, there are only two classifications, which read as follows:—

"All stones or boulders found in excavation measuring more than twenty-seven cubic feet and all solid quarry stone requiring blasting in order to remove it, shall be termed solid rock." "All other materials other than solid rock as described above, shall be termed 'all other materials,' and paid for at the schedule rate for 'all other materials.'" The solid rock definition is a great deal more definite than most, and leaves very little room for the questioning of engineers' decisions.

It may be thought at first sight, that this solid rock definition and the two material classifications would remove many of the classification difficulties, which all engineers have to face. In practice, however, even through country where, as in this case, the material can be broadly classed as rock and gravel or clay; grades of rock are met with, which, although strictly coming under the other material classification, must in equity be allowed for in part as solid rock, and one is again left with the conclusion that no specification can be drawn up, which does not require to be interpreted on the broad grounds of professional intelligence and common sense.

The first concrete pavement constructed in Schenectady, N.Y., which has recently been completed, has some interesting features. It is a one-course pavement, 7 in. thick, of 1:2:4 concrete, made of crusher-run stone graded to 1 in. in size. Expansion joints are placed at an angle of 75 degrees to the curb. William B. Landreth, City Engineer, informs the Engineering News that "while theory could easily prove that there is no advantage in placing the joints at an angle to the curb, we have decided to give the diagonal joint a practical trial. It is not straining anyone's credulity, however, to believe that the weight of a vehicle may be carried across such a small depression on three wheels." The street is 24 ft. wide, and these expansion joints are placed every 20 ft. These expansion joints are ½ in. wide and are filled with several varieties of joint filler, the intention being to observe the action of these various fillers during the fall and winter, in hopes of finding the most suitable one for the given conditions. In constructing the pavement, the gutters have been made deep enough, and the crown of the pavement is of a shape, that when the pavement is worn to an extent to make repairs no longer economical, the city will be able at moderate cost to place on the old concrete a 2-in. asphaltic-concrete surface. This is the first real concrete pavement in the city.

Proportioning Aggregates for Portland Cement Concrete

ONE of the interesting papers read before the American Society for Testing Materials at their convention was that on the above subject by Albert Moyer. This paper has been printed in pamphlet form from the proceedings of the Society and in the introductory pages Mr. Moyer gives the following summary:

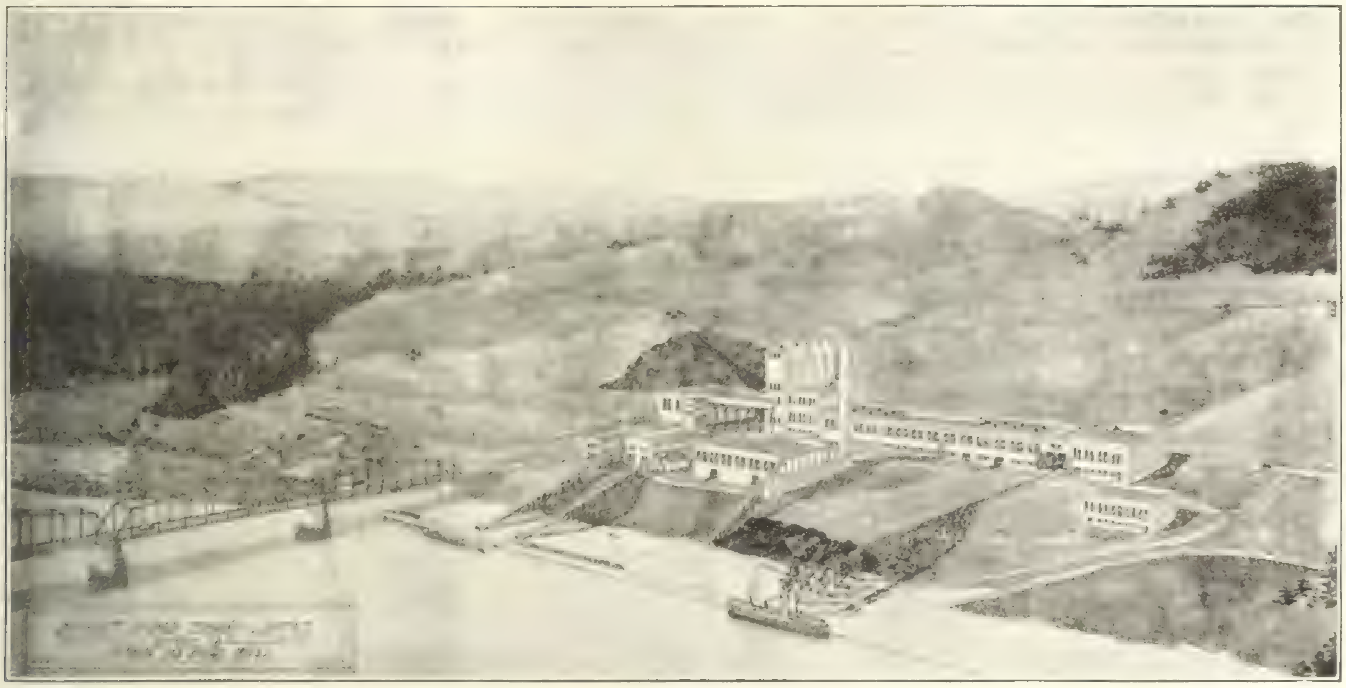
"The object of the investigations into the proper proportioning of aggregates for Portland cement concrete is to obtain maximum density which, other things being equal, the author consider gives maximum strength.

"One of the principal results obtained in these investigations was that arbitrary specifications without previous knowledge of the character of the aggregates that are to be used are wrong, and that such stated proportion as 1:2:4 or 1:3:6, etc., are meaningless.

It was found that 95 lbs. per cubic foot, or 3.8 cu. ft. per barrel, as a unit of measurement is incorrect. Investigations prove that it takes 110 lb. of Portland cement to make 1 cu. ft. of paste. The author finds that, opposed to the old plan of filling the voids in sand with cement, these voids must necessarily be filled with paste (cement and water), and that the study of the proportioning of aggregates must be based on the proper proportions of cement, water and sand to make a sufficiently rich mortar to bind together the larger aggregates. The cement must be measured by weight, using 110 lb. as equivalent to 1 cu. ft. of paste. If a 94-lb. bag is used as a unit of measurement, the proportions must be figured so that the same proportion of cement to sand is obtained as when based on 110 lb. of cement per cubic foot of paste.

"For the purpose of economy, various sizes of stone should be used and investigation made to see which sizes will produce the least percentage of voids, so that less mortar may be used and more strength obtained, for the reason that mortar is not as strong under compression as mortar and crushed stone or pebbles mixed together in the form of what we term concrete."

The paper gives various methods of carrying on investigations, so that with a given sand and a given stone or gravel, proportions can be stated by the engineer which will make a concrete of maximum density and maximum strength.



New Pulp and Paper Mill at Bathurst, N.B.

THE illustration on this page is reproduced from a perspective drawing of the new pulp and paper mill which is being erected at Bathurst, N.B., for the Bathurst Lumber Company to utilize the waste from logging and manufacturing. This mill when completed will be the largest plant of its kind in Canada. Two units of this plant will operate next summer to manufacture twenty-five tons daily of bleached Mitscherlich sulphite pulp, and sixty tons daily of extra strong container board. The pulp mill is located at the mouth of the Nepisiguit River. A branch line of the Intercolonial Railway will run directly into the mill. The construction of the plan involves interesting problems with which we hope to deal in detail in a later issue of the Contract Record.

Cost of a Damp-Proof Timber Floor

ENGINEERS are frequently called upon to design and build floors in industrial buildings where water under a head is not encountered, but where protection against dampness must be provided, says J. A. Holmes in an article in The Engineering News. This applies to basement and ground floors where the practice was formerly to carry such floors on heavy timbering, supported by piers, thus providing an air space and more recently by laying the floor directly on a concrete base and spiking to strips embeded in the concrete.

Neither of these methods prevents decay. More recent and extensive practice is to introduce a damp-proof construction under the wood surface directly on the ground. If water is present, a system of underdrainage is necessary.

Where the ground has sufficient natural drainage and no tile is required, the foundation course is laid directly on the ground. On this foundation is spread a layer of tarred sand in which planks are bedded by ramming and on which the hardwood wearing surface is laid and nailed. A floor of this character provides a rigid foundation for machinery and will support the heaviest materials in storage.

A damp-proof floor of this kind was recently built, on which a careful record of cost was kept. The floor was laid in the basement of a manufacturing building on the natural earth, hardpan and sand, without underdrains. The ground was prepared by the contractor for the building by rolling or puddling, therefore, the costs given in the accompanying table are for materials and labor above the ground.

The soft-coal cinders used for the foundation course were purchased from the railroad and delivered in cars on a siding from which they were shovelled directly into the basement where used. Materials were delivered and the work performed in the winter, so that storage in the basement obviated the necessity of heating the cinders when mixed with the tar. Tar was purchased from the local gas works and 14 gals. used per cu. yd. of cinders.

The cinders were spread, rolled and tamped to a thickness of 4 in.; the shrinkage from measurement in cars to place was 36 per cent. Sand and tar were heated outside the building and mixed in the basement. This mixture, while warm, was spread over the cinders and screeded off $\frac{3}{8}$-in. above the bottom of the plank; planks being laid to grade for screeding. Into the sand while still warm, the 3-in. planks were firmly bedded by ramming.

For specially prepared tars, 50 to 60 gals. per yd. of sand are specified. On this work the greatest amount of tar that the sand could be made to contain, without making a soft, wet mixture, was 35 gals. per cu.

yd., the same kind of tar being used in both cinders and sand.

The plank was 3-in. kyanized hemlock, planed one side to a uniform thickness of 2¾ ins. and not less than 6 ins. wide, random lengths, square edged and saw butted; laid to break joints and toe nailed but not driven tightly together. There was no loss of plank by cutting.

Over the plank were placed two layers of felt and one of pitch. The felt weighed 14 lbs. per 100 sq. ft. and was laid to break joints one-half the width of the sheet; no pitch was allowed to come in contact with either plank or top floor. The loss in area of felt due to lapping was 21 per cent.

Over the felt and at right angles to the plank was laid a maple-top floor 1 1-16-in. thick.

The waste and shrinkage due partly to laying, but mostly to manufacture, was 40 per cent.; in other words, while the market price of the flooring was $45 per M., the shrinkage in manufacturing that must be paid for, plus a small loss by waste in laying, brought the cost up to $63 per M.

In this work, two distinct classes of labor or trades were employed, roofers in this case and carpenters, and though they worked together, their organizations were separate. For this reason, the combined items for superintendence is high and that for superintendence of roofers unnecessarily so. Reducing the item for superintendence of roofers and using untreated plank and leaving out the felt and pitch between plank and top floor, the cost would be reduced as shown in the last column of the table.

Cost of damp-proof floor

Materials and labor	Thickness of material in place	Quantity per sq. yd.	Unit cost	Cost per sq. yd.	Per cent. of waste and shrinkage	Cost per sq. yd.*
Cinders........	4 in.	0.151 cu.yd.	$0.50 per cu.yd	$0.076	36	$0.076
Tar in cinders..		0.0381 bbl.	2.00 per bbl. (57 gal.)	0.076		0.076
Sand..........	1 in.	0.045 cu.yd.	1.00 per cu.yd.	0.045	68	0.045
Tar in sand....		0.0276 bbl.	2.00 per bbl. (57 gal.)	0.055		0.055
Felt...........	2 ply	3.10 lb.	35.00 per ton	0.054	21	
Pitch on felt...		3.32 lb.	17.00 per ton	0.028		
Teaming, tar..			0.50 per hr.	0.039		0.039
Labor, roofers..			0.375 per hr.	0.433		0.358
Supt., roofers..			0.50 per hr.	0.100		0.078
Kyanized plank	2½ in.	0.027 M.	33.50 per M.	0.905	00	0.756
Maple top floor	1 1/16 in.	0.0134 M.	45.00 per M.	0.603	40	0.603
Nails.......		1.2 lb.	2.10 per cwt.	0.027		0.027
Carpenters....			0.41 per hr.	0.475		0.475
Labor			1.75 per day	0.230		0.230
Supt...........			0.50 per hr.	0.080		0.080
Totals ...	9 in.			3.226		2.898
			Materials	1.869		1.638
			Labor	1.357		1.260

*Cost omitting felt, pitch on felt, labor placing felt and pitch and using untreated Hemlock plank @ $28.00 per M.

Concrete blocks are to be used for lining the new lake intake tunnel for the Cleveland water supply. The new tunnel is 10 ft. in diameter and 16,000 ft. long from crib 4 to crib 5 in Lake Erie. Crib 4 is located about 1 1-3 miles from shore and crib 5 about 4 miles from shore. About 300 ft. of the tunnel have been constructed with a lining of four rings of brick. The city has recently erected a shield to be used in the construction of this work. The concrete blocks with which it is proposed to line the tunnel will be manufactured and used according to the system patented by Walter C. Parmley, of New York City. According to information received from C. F. Schulz, commissioner of water, a contract has also been made with Charles J. Carpenter and L. W. Anderson, of Grand Rapids, Mich., for the use of two tunnelling machines designed and patented by them.

Portland Cement Concrete as a Paving Material

An interesting discussion of the adaptability of Portland cement concrete for paving purposes forms a part of a paper entitled "Concrete Pavements" which was presented at the recent convention of the American Society of Municipal Improvements by H. G. Lykken, City Engineer of Grand Forks, N.D.

In introducing his subject Mr. Lykken refers to the amount of concrete pavement that is being built and predicts that as regards yardage laid it will soon be "in a class by itself." He ascribes the growing use of concrete, especially in rural work, to the abundance, wide distribution and relative cheapness of the materials employed in its construction and to the relatively lower labor cost of laying it.

All, or nearly all, pavements, according to Mr. Lykken, have their places when regard is had for traffic conditions, climate, first cost and the many other factors entering into an intelligent choice of the best for the case under consideration. But he holds, in addition, that the cement concrete pavement is "so much cheaper in the first cost, so eminently satisfactory under the great variety of conditions it already has been subjected to, that it is well worth investigating just what traffic and other limiting conditions it may be subject to before we pass it by for more expensive surfacings." He states that it would be absurd to claim that a concrete pavement is suitable under every urban condition, but that it is a fact that such a pavement "is suitable for a greater variety of conditions and worthy of greater consideration than that accorded by most engineers at the present time."

It is natural, according to Mr. Lykken, that with so great a yardage, many pavements can be found that are poor or at best indifferent. No one, he argues, would admit that the best student of concrete surfacing among our most eminent road engineers knows all there is to know about concrete pavements, or could lay these pavements with uniform success. We still differ so greatly regarding methods. according to Mr. Lykken, that there are many problems demanding careful consideration.

The first of these problems taken up in the paper is traffic. For rural roadways, Mr. Lykken believes, there is no longer any question as to the adaptability of the concrete pavement, and he states that he is firmly convinced that "it will never have a close competitor except in restricted areas where asphalt is a local product, or where the same can be said of good paving brick." Its low cost and the ease with which it can be kept clean, place it first as an alley and courtyard pavement, for which purposes "it approaches, indeed, an ideal pavement," and has been most widely used in city work to date. He argues that from this would naturally follow its use in somewhat similar conditions—that is, where the traffic moves slowly, but states that it must be admitted that a concrete paving is not suitable where there is more or less fast-moving, horse-drawn traffic. He states that in such cases it is too hard on horses, qualifying the statement by another to the effect that the same can be said of brick or stone pavements. He also states that concrete is not suitable for heavy grades. Continuing, he says:

"But in wholesale and factory districts where the traffic is largely motor-driven or slow, heavy trucking, the hard, even surface of the concrete can not be surpassed. With proper construction and proper materials used, it should wear as well if not better than stone or brick on account of the absence of joints. The one drawback is the greater difficulty of replacement when it does give out and the surface becomes too rough for further use. And here the writer wishes to raise the question, would it not be desirable to lay it in two courses, say 6 to 8 ins. of sub-base, then a wearing surface of 4 to 6 ins., with a parting film of oil or asphalt so that the wearing surface could be stripped off as brick or wooden block surfacing? This would apply only to extra heavy traffic conditions."

On residence streets and on cross-town streets, carrying very little through traffic or very little horse-drawn traffic, according to Mr. Lykken, concrete is eminently suitable, being easily kept clean. While it is often argued that concrete pavements are noisy, according to Mr. Lykken, they are certainly not more so than brick, stone or even creosoted wood blocks.

In summing up, Mr. Lykken states that the concrete pavement with its low first cost and durability demands first consideration for rural roadways, and that with the additional qualities of ease of cleaning and cleanly appearance it ranks high for pavements for alleys, courtyards, cross-town streets, streets in wholesale and factory districts "and, in fact, all streets where the traffic is essentially motor-driven or slow-moving, and in residence districts where there is little or no through traffic." Where there is considerable through traffic or fast-moving, horse-drawn traffic, according to Mr. Lykken, the more resilient pavements of the sheet asphalt or asphaltic concrete type are without question the more desirable, just as in business streets carrying heavy traffic, where the constant grind and pound necessitate continuous patching and repairs, some type of block, either of brick or stone, will prove the more satisfactory.

Details of Construction Which Make Brick Pavements Good or Bad

THE importance of details as factors of good roads construction is emphasized by the brick highways in Erie and Niagara Counties, New York, which were inspected during the recent annual convention of the National Paving Brick Manufacturers' Association, at Buffalo. Good construction, bad construction and intermediate grades were exemplified. Different kinds of brick, and different makes of the same kind of brick have been used, but while the brick highways range in quality from bad to perfect the differences among them are not wholly attributable to variations in the quality of brick. Both good and bad roads are built of the same kind and make of brick, and sometimes the same contractor built both kinds of roads with one kind of brick.

A noticeable distinction between types of brick was found in the fact that even on roads of inferior construction the sections laid with square-edge brick were uniformly better grouted than were sections of the same roads laid with round-edge brick, although instances of faulty grouting occur with both types of brick.

Damage at Expansion Joints

The contractor has not been at fault in all cases, although his sins of omission and commission are many. The worst roads are those having cross expansion joints. Pavements otherwise in good condition show courses of broken and sunken joints at regular intervals of 50 ft. on account of transverse expansion joints. In some instances courses of brick on each side of the cross expansion joint are broken. But cross expansion joints were specified, and the contractor was obliged to put them in.

The best pavements, and the only perfect pavements, were those having longitudinal expansion joints only, although not all pavements having longitudinal joints were found in good condition. It can, however, be affirmed without fear of successful contradiction, that neither in Erie County nor in Niagara County was there seen a cross-expansion joint pavement in perfect condition after two years of service. On some highways, notably road No. 2, running out of Hamburg, cross expansion joints and longitudinal expension joints show at a great disadvantage.

Grouting and Rolling

The visitors received ample proof that a perfect brick highway can be laid and that it will remain unimpaired under traffic conditions for years. The reverse of the picture was exhibited as well. Slipshod methods of construction have been responsible for poor pavements. Faulty foundations and poorly prepared sand cushions are accountable for some defects, but by far the most prolific cause of poor pavements—excepting cross expansion joints—is poor grouting. Poor materials and materials mixed in wrong proportions contribute to poor surfacing, but as a rule either ignorance or carelessness in applying the grout is the source of failure. Too much care cannot be exercised at this stage of construction, but observation teaches that some contractors attach little importance to the details of grouting.

A tour over construction work discovers another cause of poor pavement in the laying of long stretches of brick ahead of rolling and grouting. This method is destructive in case of rain, as brick on a wet sand cushion cannot be rolled without forcing the sand up between the joints. This disrupts the smooth, compacted bed upon which the brick rest and the sand between the bricks prevents the bonding material from penetrating to the bottom of the courses and forming a strong bond. Brick rolled on a wet sand-cushion will rock, nor can a smooth, even pavement be made with a wet sand cushion under it. Contractors are not ignorant of these facts but they take chances and sometimes, unless closely watched by the engineer in charge, they grout over a pavement laid on a wet sand cushion and cover up their folly temporarily. It saves taking up the brick and relaying them. It is easy to uncover such fraudulent work by pulling out a brick here and there, and noting how far the sand has been forced up by the rolling of the brick.

All work should be rolled before leaving it at night. The roller should follow the pavers closely and the grouters should keep as close to the roller as practicable, closing up the work each night. Yet some

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By F. A. [illegible] of the Dunn Wire-Cut Lug Brick Company, in the Engineering Record.

times engineers permit contractors to lay a quarter of a mile or more of brick ahead of the grouters.

Two evils arise from this course—first, the danger of rain on the sand cushion; second, the mixing and the dumping of too much filler at one time in order to rush the work. Unless closely supervised grouters will mix batches too big, and they will put enough grout on the pavement to grout 15 ft. instead of the maximum permissible limit of 5 ft. The inevitable result of putting an excess of grout on a pavement at one time is the same as the result of mixing batches that are too big, namely, separation of sand from cement and consequent weakening of the bonding material. Bridging of joints is another peril from dumping grout on the pavement.

Proportioning Grout

Another observed tendency of grouters is to mix the final coat of grout too thin or too thick. If too thick, the grout bridges the joint; if too thin it settles in the joints instead of setting flush with the pavement. The general tendency is to mix the first grout too thick and the final course too thin. The final grout should be somewhat thicker than previous courses, but it should not be too thick nor should too much of it be put on at one time; it is imperatively necessary not only that the batch be kept thoroughly mixed but it must be thoroughly squeegeed into the joints. In one instance workmen were observed thinning grout by pouring water on it on the pavement, thereby separating the constituent elements of the grout and destroying its efficiency. This fault was corrected, but there is reason for believing that that method of thinning grout is somewhat general. The right way, therefore the only way allowable, is to thin in the grout box and keep constantly stirring.

Contractors and engineers, unless thoroughly experienced in highway work and conscientious in their work, are prone to neglect or slight what appear to be minor details, nor in their methods do they always discriminate between the two kinds of brick commonly used for paving.

Method of Finishing Grouting

The method of finishing the grouting of a brick pavement differs with the type of brick used. The final course of grout on a round-edge brick pavement should be squeegeed until the surface of the pavement is as nearly as practicable free from grout; otherwise, when the excess grout breaks under the pounding of traffic and comes off, it will pull portions of the grout from the round-edge joints. No such danger from a heavy surface coating of grout menaces a pavement laid with square edge brick. The square edges of the brick protect the joint and the excess of grout comes off the pavement without impairing the grout at the joint. The difference between round-edge brick and square-edge brick in respect to the final grouting is this: whereas in tre case of the former all the surplus grout ought to be squeegeed off the pavement, in the case of the latter the surplus may be taken off or left on without deleterious effect. The objection to leaving a thick covering of grout over the pavement is that it is unnecessary and, therefore, wasteful.

The tour of the brick roads of Erie County disclosed the fact that in some instances the failure of contractors properly to protect the freshly grouted pavement with a blanket of moistened sand had resulted in too rapid setting of the filler. The result was "crazing" and pin-cracking of the grout. The same condition was found on the Kennilworth Avenue pavement recently laid by the city of Buffalo.

Laying the Brick

Brick laid with lugs the wrong way brought together two smooth sides of adjoining brick, thereby preventing the penetration of filler and preparing the way for defective spots in the completed pavement. Such faults are the result of inexcusable carelessness, but competent engineers and inspectors detected them in time to forestall serious consequences.

Another indication of neglect to follow specifications was observed in the placing of the uneven or broken edges of bats next to the curb. This is not, perhaps, a serious structural defect, yet it is both aesthetically and practically wrong. It detracts from the symmetrical apearance of the pavement at the sides by giving it a rough, uneven edge, and it deprives the pavement of the extra bonding strength afforded by union of the filler with the rough surface of the bat. Some persons may regard these strictures as hypercritical, but no detail of construction is negligible. A good pavement represents the homogeneous aggregate of all constructive details properly wrought out.

Foundation Drainage

The necessity for proper drainage of foundations was strongly impressed upon observers of brick highways in Erie and Niagara Counties. There are miles upon miles of pavements without cracks, sunken spots, broken bonds or other noticeable defects, yet several highways show cracks and sunken spots unquestionably due, in the first instance, to ineffectual drainage. While it is probably true that longitudinal cracks sometimes result from causes other than defective drainage, a well-constructed foundation, properly drained, is a sure preventive of sunken spots in a pavement, nor are cracks likely to occur unless moisture is taken into the foundation either by direct contact or by capillary attraction.

The tour of inspection around Buffalo found apparent evidence of negligence in the matter of drainage, but conclusive proof was adduced that a well-drained and well-constructed grouted brick pavement is impervious to surface water. Portions of the brick boulevard running from Buffalo to Niagara Falls were submerged by the flood a couple of years ago, for a period of two or three weeks, yet they were absolutely unharmed and were marked neither by cracks, nor depressions, nor by broken bonds. Damage to brick pavements resulting from moisture originates beneath the foundation. That the problem of drainage can be solved even under adverse natural conditions is a fact which was demonstrated on the tour.

Cull Brick

For almost its entire length of 23 miles the boulevard between Buffalo and Niagara Falls runs through a level country, and the same is true of the highway between Lewiston and Youngstown. Yet in the former only a few bad spots exist, and in the latter none at all. The worst spots on the boulevard are attributed to the use of cull brick. This brick, it is alleged, was condemned in Niagara County, but by some means the culls found their way across the line into Erie County and were placed in the pavement at two points. It might be an idle waste of time to speculate on the sequence of events which eventuated in the translation of brick from a cull pile in one county to a snug place in a State boulevard in the county adjoining, but it is only fair to say that the manufacturer who furnished the brick says he received cull prices for the cull brick and was not cognizant of the high destiny which awaited them. Without attaching to the incident any remote significance, the incident does emphasize the need for close supervision of construction work by engineers in charge, and it puts an acute accent on the necessity for honest, capable and diligent inspection. Eternal vigilance is the price of a good pavement.

Inspection

Poor judgment of the qualities of brick is a weakness not infrequently found in inspectors. Among culls thrown into the discard by inspectors on construction work were found what practical men declared to be the very best brick in the shipment. Conversely, some of the brick that were passed were of inferior quality. Without making any specific application to individuals or to any particular job, it is safe to affirm that inspection of brick on the roadway is to some extent a matter of individual preference, and in many cases inspectors are not qualified by experience or by native ability to judge correctly of the quality of brick by its appearance. The result is an almost total absence of uniformity in standards of judgment and an insistent demand for a better system, or at least for expert inspection.

There does seem to be among inspectors a common prejudice against brick of a dark shade, although it is quite possible that such brick may be exceptionally durable. The shade is not always an indication of overburning. The inspection of brick is often delegated to persons selected without regard to their fitness for the duty; and brickmakers may be mulcted from 2 to 3 cents per brick on large consignments by the ignorance of inspectors appointed for political reasons or for other reasons equally obnoxious. Nor is the abrasion test always fair to the brickmakers.

These reflections and comments are based upon observations made on old and new work in a recent tour of two hundred miles over highways in Erie County and Niagara County, New York.

Simple Rules for the Weight of Iron and Steel Bars

The following simple rules for figuring the weight of iron and steel bars are given by Ferro-Concrete.

Round Steel Bar—Square the number of quarters of an inch in the diameter, and divide by 6, the result being the weight in lbs. per ft. run.

Example for 1½-in. diam. bar: $6^2 \div 6 = 36 \div 6 = 6$ lbs. per ft. run.

Square and Flat Iron Bars—Multiply the number of sq. in. in the cross-section by 10 and divide by 3, the result being the weight in lbs. per ft. run.

Example for a 2-in. by ½-in. bar: $1 \times 10 \div 3 = 3.33$ lbs. per ft. run.

Example for 1½-in. × 1½-in. bar: $2\frac{1}{4} \times 10 \div 3 = 7\frac{1}{2}$ lbs. per ft. run.

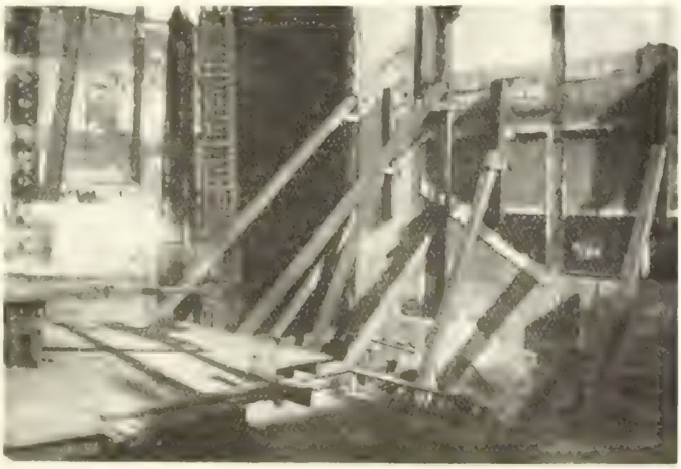
Square and Flat Steel Bars—Proceed as for iron and add 2 per cent. to the result.

Cleaning Pressed Brick Stained by Smoke

FOR the cleaning of brick in the walls of a church that had been blackened by coal smoke and which settled on the coping and washed down over the light-colored hydraulic pressed brick, and where dilute muriatic acid, pearline and other substances had been tried without satisfactory results, the Painters Magazine suggests the following: Muriatic acid will not remove smoke stains, nor will soda or soda ash do it. Smoke stains must be removed by scrubbing and rubbing with the proper solutions. Try the following method: Mix one gallon soft soap, two pounds powdered pumice and one pint of liquid ammonia, beating the mixture well. After carefully dusting the brickwork, apply the mixture. This should be in the form of a soft paste, in a fairly thick layer with a fibre brush, allowing it to remain for about twenty minutes; then rub it in on the bricks with a good, stiff scrubbing brush, using plenty of elbow-grease. Use a large sponge and plenty of lukewarm water to remove the lather, and then rinse with clear water, or, if convenient, use a hose for rinsing. This, if properly done, will remove the most stubborn case of discoloration by smoke from brick or stone.

An Interesting Piling Contract at Montreal

As already stated in the Contract Record, difficulties were met with in excavating for the foundation of the new Bank of Toronto to be erected at the corner of McGill and St. James Streets, Montreal. Tests made by the consulting engineers indicated that one-half of the site, next to St. James Street, was able to carry the heavy load which would be imposed upon it, while the other half was of such a nature that it was necessary to use some system of deep foundation in order to develop the ground to a bearing value equal to the good half.


Illustrating method of bracing walls

After considering several methods, the engineers decided to employ concrete piles, and the contract was awarded to the Simplex Construction Company, of Montreal, who had previously carried out piling contracts at the extensions of Nos. 1 and 2 elevators of the Montreal Harbour Commissioners, Dominion Coal plant, and Grand Trunk elevator, Windmill Point.

The contract for the Toronto Bank building involved the placing of 150 Standard Simplex piles. The pile driver is mounted on two heavy iron rollers under which large timbers are placed. The cast iron point weighing about 150 pounds receives the end of a 16-in. steel form in such a way that it effectively seals it. A cast steel driving head is used, this fitting the leads of the driver so that it keeps the form in place and holds a wooden block on which the hammer falls. After the 16-in. form is driven down to a penetration of ½ in. under the blow of a 3,000 pound hammer falling 15 feet, the driving head is removed, reinforcement placed inside the form and concrete poured in until the form is filled. The form is then withdrawn, leaving the point at the bottom; the result is a reinforced concrete column of uniform diameter throughout. The machine is afterwards moved to the location of the next pile. Piles have been driven to a maximum depth of forty-seven feet below the excavation, which means that the foundation extends about sixty feet below the street level. A foundation extending so far below the street level should be positive protection against any disturbance which might otherwise be incurred by the installation of subways, etc. The piles driven on the job referred to will each bear a minimum load of thirty tons.

In placing the piles for this foundation it was necessary to drive close to the walls of the adjoining buildings, which were, owing to age and several fires through which they had passed, in bad condition. As a matter of precaution heavy bracing was necessary, but the piles were driven without any serious disturbance. The entire site will be covered with a reinforced concrete matt, so as to ensure a uniform foundation.

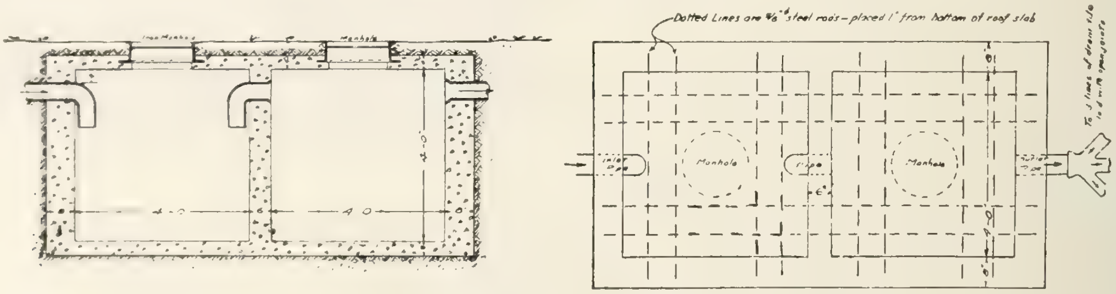
The Simplex Company placed the piles in about a month, which, under the conditions, is considered very rapid work.

Construction of Concrete Septic Tanks*

A Sewage Disposal System for Country and Suburban Houses—Size and Location of Tank—Materials Necessary

THE well-managed farm of today means many household conveniences as well as labor-saving farm machinery. Back-breaking drudgery has been largely eliminated from both house and fields. Running water and the kitchen sink and bathroom have supplanted the old-time pump and open, insanitary drainage. But the most efficient disposal of sewage remained a problem until the concrete septic tank was invented. It is a simple, cheap and effective device, rapidly supplanting the drywell, with its constant menace of water pollution. In brief, there has come to the farmer his own little sewerage plant in concrete, which answers his purpose even better than large city works, for he has neither the tax nor repairs that attach to a city sewer system.

The principle upon which the concrete septic tank operates is extremely interesting. It consists of a long, water-tight cistern, through which sewage passes very slowly and evenly. Located underground, it is warm and dark, thus affording perfect conditions for the development of the bacteria or germs which clarify and render harmless the sewage. After passing through the septic tank, the sewage is practically free from all suspended matter and has the appearance of water. From the septic tank this clear effluent is discharged into three lines of ordinary farm drain tile.


Iron Manhole
Manhole
4'-0"
6"
4'-0"
4'-0"
Dotted Lines are 3/8" steel rods – placed 1" from bottom of roof slab
Inlet Pipe
Manhole
Pipe
6"
Manhole
Outlet Pipe
8"
4'-0"
8"
To 3 lines of drain tile laid with open joints

Construction of concrete septic tanks.

Size and Location of Tank

While the odor from a septic tank is scarcely noticeable, it is nevertheless best to locate it at some distance from the house. Choose a spot easy to excavate so that the top of the tank can be sunk 6 inches below ground level and where the lines of drain tile will have sufficient fall to carry off the discharged fluid. The tank should be large enough to hold the ten people occupying a house having two bathrooms fitted with the customary washstands and downstairs the kitchen sink, a concrete tank having two compartments, each 4 feet long by 4 feet wide by 4 feet high, will be required. Since the top and bottom are each 4 inches thick and the top of the tank is 6 inches below ground level, dig the pit 5 feet 2 inches in depth. The walls of the tank are 8 inches thick and the partition between the two compartments 6 inches. Therefore, the length of the pit should be 9 feet 10 inches and the width 5 feet 4 inches.

Making Forms and Placing Concrete

If the earthen walls of the pit stand firm only inside forms will be needed. These inside forms are merely boxes made of 1-inch boards. The boxes will be required to make two compartments. The outentire sewage for one day. For a family of eight to side dimensions of the boxes should be 4 feet square by 4 feet high. The boxes or forms will be placed on the freshly laid concrete floor. Holes for taking 6-inch pipe should be made in the boxes as shown in Fig. 1. The holes should be 4 inches from the top of the box form, measuring from the top of the hole. The concrete should be mixed in the proportion of 1 part Portland cement, 2 parts sand and 4 parts crushed rock or gravel. Place a 4-inch thickness of concrete in the bottom of the pit to form the floor of the tank. On top of this concrete set the box forms, which should be ready for immediate use. Place the forms so that there is a space of 6 inches between them and an 8-inch space between them and the earthen walls of the pit. Then commence depositing the concrete for the walls and partition. As soon as the level of the concrete reaches the holes in the forms place in the holes 6-inch pipes as illustrated. Then continue the concreting until even with the top of the forms.

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*By Percy H. Wilson in the Building Age.

Reinforced Top and Manholes

Two ordinary iron manhole frames and covers may be obtained from a local dealer in building supplies. The manhole covers should fit tightly and should not be perforated. The manhole frames should be 10 inches high so that when placed on top of the forms the upper edge will be even with ground level. If the manhole frame is of less height than this, it should rest on a circular piece of 1-inch board, which is nailed to the top of the form. Since the concrete roof is to be self-supporting, it will be necessary to reinforce it with a few lengths of ⅜-inch round steel rods. There will be needed 4 pieces of ⅜-inch rods, 9 feet 6 inches long, and 8 pieces 5 feet long. The roof is now ready to be placed. Place the manhole frames in proper position on top of the form, and deposit the concrete to a depth of 1 inch and on the concrete lay the long and short bars, as shown in Fig. 2. When the bars are placed, deposit the balance of the concrete so as to bring the roof to a total thickness of 4 inches. As it will be covered with earth it is not necessary to give this top surface a smooth finish, merely level the surface by striking off with a straight piece of board. The tank should now be allowed to rest undisturbed for at least two weeks. At the expiration of this time, saw away wooden top of the forms inside of the manhole frames. Then enter the tank and remove the wooden forms, passing the lumber out of the manhole opening. While in the tank make certain that the pipes are all unobstructed and not even partially clogged with dirt or lumber. The inlet pipe is then connected to the pipe from the house and the outlet pipe joined to three lines of 3-inch concrete drain tile. The drain tile will be laid about 12 inches below the surface of the ground and the joints left open, that is to say, no mortar must be used in the joints. This permits the discharged fluids to be absorbed by the surrounding soil. The drain tile lines should be laid in the form of the letter "Y" and sufficiently extended to cover a large area of ground. Average conditions require that each arm be about 100 feet long. After this is done, cover the tank with earth to the level of the manhole covers. It is now ready for use.

Materials Necessary

A tank of the size specified will require about four cubic yards of crushed rock, two cubic yards of sand and seven barrels of Portland cement. There will also be needed 78 feet of ⅜-inch round steel rods, which can be obtained from the local blacksmith or hardware dealer. The tank can be built without skilled labor. It requires few tools and construction methods are so simple that any man can build it.

Causes of Failures in Concrete Structures

FAILURES in concrete or reinforced concrete structures may be divided into two classes, says Concrete-Cement Age,—(1) failures from unavoidable causes, and (2) failures from preventable causes.

Failures from unavoidable causes include those resulting from earthquakes, explosions, lightning, fire, inundations, tempests and exceptional shocks. As these causes are, by their nature, unavoidable, nothing further need be said about them beyond the remark that concrete structures, if designed for the purpose, will withstand most of these forces as well as or better than any other building material.

Failures in plain concrete structures from preventable causes are almost invariably due to mistakes or carelessness in construction, some of the common causes of failure being as follows:

(1) Use of green and unseasoned cement as well as poor cement. A branded American cement is usually reliable, but it must not be too quick setting or lumpy or caked.

(2) Unsuitable aggregates, i.e., inferior grades of sand and stone. It is particularly necessary to avoid using any aggregate that may be handy. The best for the purpose should be chosen. It is also unwise to accept aggregates on the basis of small samples.

(3) An insufficiently graded aggregate, particularly one containing only very coarse material, or one with too much sand or loam. Natural aggregates are risky on account of the variations in the proportion of sand they contain, and should be screened before use.

(4) Dirty aggregate or water containing earthy matter, clay loam, or strongly colored water.

(5) Carelessness in proportioning mixtures.

(6) Badly mixed concrete, i.e., incomplete incorporation of the aggregate with the cement.

(7) Too much water during mixing, or water carelessly applied, or an insufficient quantity of water to permit the concrete to attain its full strength.

(8) Allowing the concrete to stand until the setting action has commenced and then re-gauging before use, or using up old concrete.

(9) Setting concrete work on dry foundations and without thoroughly saturating the surface with water.

(10) Excessive ramming or tamping.

(11) Placing concrete in the winter months and allowing the material to become frozen before the cement has attained its final set.

(12) Excessive use of calcium chloride for lowering the freezing point.

(13) Placing concrete in very hot weather when the temperature of the water is around 90 deg. F. to 100 deg. F., the cement at the same time being improperly seasoned, with the result that the cement gets an initial set in the mixer and is thereby broken when placed in the work.

(14) Excessive trowelling or floating of cement surfaces.

This analysis will show that a great number of the failures are due to mechanical incompetency.

From the past history of concrete there is good reason to believe that if Portland cement is properly manufactured, the proper kind of aggregates used and the work properly done, structures built of concrete will be reasonably permanent.

Concrete is one of the best and most reliable of building materials when mixed and put in place in a proper manner; where there have been failures in reinforced concrete buildings or other reinforced structures for that matter, it has generally been due to one or more of the following causes:

1. Premature removal of forms. Too early removal of forms has been the cause of most of the deplorable accidents in reinforced concrete construction.
2. Insufficient or badly arranged forms and supports.
3. Erroneous design, i.e., errors in calculation or insufficient and poor reinforcement.
4. Mistakes in the construction of the columns.
5. Unsuitable aggregate or cement.
6. Poor mixing.
7. Bad workmanship or in efficient supervision.

8. Misplacing or omitting the reinforcement.

Any of the above causes or any of those stated for plain concrete failures may be responsible for a reinforced concrete structure being a failure, but there is absolutely no reason, if these matters are carefully attended to, why every structure should not be a complete success.

It is a noteworthy fact that practically no "mysterious" failures have ever occurred in concrete structures long after they have been completed, so that it may be assumed that in almost every case the failure has been due to some error in construction.

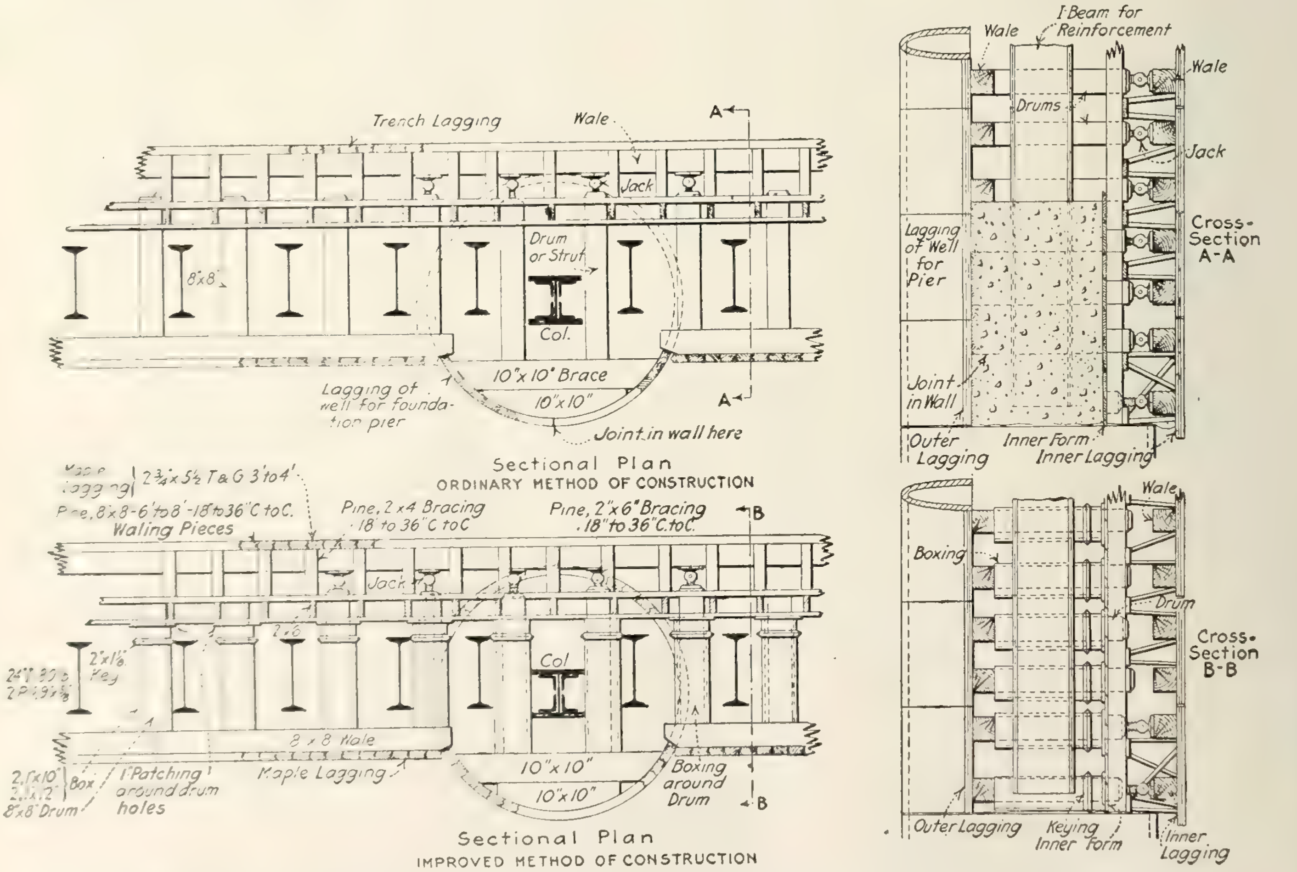
The carelessness and ignorance of some contractors who undertake concrete work, and the indifference they show with regard to inspection during construction, make it essential that all concrete work should be placed in the hands of skilled and trustworthy men. While the contractor should not be absolved from blame, yet the engineer and the architect, who do not know the dangers, must equally share the responsibility. It is their business to know the necessary precautions and to insist that a competent concrete engineer or experienced inspector be put on the job, to stay there until the work is completed. It is high time that those be adjudged incompetent who fail to insist upon such supervision.

It is confirmed, concludes our contemporary, that all localities in which a good code of regulations is enforced have proved free from great disasters of a preventable nature.

Construction of Retaining Walls of Deep Basements in Clay Ground

In many of the large new office buildings in Chicago, having foundation piers sunk through the clay bed to rock, a portion of the area is excavated for two or three (or even four) basement floors. These excavations must be surrounded by heavy retaining walls to resist the pressure of the clay. The walls are built in trenches excavated to the required depth, lined with sheeting against which are placed waling timbers, braced by cross timbers or "drums" having a jack screw or trench brace between one end of the drum and the waling timber.

Under the ordinary method of building the wall, the forms are placed in position in the trench thus braced, and then concrete is deposited up to the level of the bottom of the first row of drums. This layer of concrete is allowed to set or harden for 12 to 24 hours. New drums are then placed behind the concrete-filled portion of the form. Then the drums and



Methods of Constructing Retaining Walls for Deep Basements in Clay Soil at Chicago

The upper drawing shows the method ordinarily used. The lower drawing shows the improved method employed by Holabird & Roche on the new Lumber Exchange Building.

jacks of the row above the concrete are removed, after which the forms are set for the next course and another layer of concrete is deposited to fill to the level of the next row of drums. This is indicated by the horizontal dotted lines in the upper drawing of the accompanying cut, and the operations are continued successively until the top of the wall is reached. The outer lagging is left in place, but the outer waling timbers are removed at the same time as the drums.

This method has several disadvantages, one of them being the slow rate of progress on work where rapid construction is usually most desirable. Then, the walls are not monolithic, but are composed of a series of separate horizontal courses, and although these are united by keys or ribs, the arrangement is not well adapted to resist heavy láteral pressure. Certain floor panels in the floors above must be left open to allow of placing a reinforcement of vertical steel beams, as it is not satisfactory to use steel-rod reinforcement, owing to the large number of horizontal joints and the difficulty of taking care of shear. The pressure of the earth also has to be resisted by the green concrete, which in many cases is displaced or distorted to some extent. This allows a movement of the clay body which may affect adjacent buildings.

In the construction of the Lumber Exchange Building, at La Salle and Madison Streets, a new method was adopted for building the sub-basement retaining walls, the lower sub-basement floor being about 50 ft. below the street. The trenches were excavated in alternate sections, the joints being at the centres of the columns. They were 6 ft. wide, and sunk in 3-ft. lifts, each lift sheeted with 3 x 6-inch vertical lagging and two lines of 8 x 8-in. horizontal waling. The 8 x 8-in. drums were then placed between the waling timbers and made as tight as possible by the screws. This process was continued lengthwise in 6-ft. sections along the trench and then downward to the desired elevation.

After the excavation of the trench was completed about 6 in. of concrete was deposited for a working floor and forms were built for the full height of the wall. The forms were cut away around the drums, which were boxed in or cased with 1-in. lumber; ribs on the boxing formed grooves or keys for bonding with the concrete filling later.

Then the trench was concreted from base to top in one operation, thus giving a homogeneous or monolithic wall, which was allowed to set for about two weeks, the pressure of the earth during that time being resisted by the drums or struts and not by the forms and concrete as in the other method described. The outer waling and lagging are left in place. When the basement is excavated the inner lagging is removed, the drums are pulled out of their boxing, and the inner form and boxes taken down. The holes left by the boxes are then filled with a dry concrete, well rammed, which is held in place by the notches or grooves formed by the keys. This method is shown in the lower drawing.

The advantages of this method are that the work progresses much more rapidly and gives a monolithic construction, while it eliminates the objection to rod reinforcement in these walls (though in this case some of the walls contain I-beam reinforcement). Another important advantage is that the drums take up the pressure, and relieve the wall of all pressure until the concrete has become thoroughly set and hard.

The building in question is a 16-storey office building about 135 x 101 ft., 200 ft. high above the street and with its sub-basement (for boiler room) 50 ft. below the street. The prevention of any movement of the clay bed was very important, since the 16-storey Y. M. C. A. building with floating or grillage foundations adjoins the south side of the site, while the 13-storey Tacoma Building, also with float foundations, is across the street, and an old 3-storey building with surface foundation is adjacent.

The architects are Holabird & Roche, of Chicago, and the new method of basement wall construction was devised by them. The George A. Fuller Company, is the general contractor.—Engineering News.

Miscellanea

The American Society for Testing Material has added to its specifications for reinforcing steel rolled from billets, an intermediate grade between the structural and hard grades. The new grade has a yield-point of 40,000 lbs. and an ultimate tensile strength of from 70,000 to 85,000 lbs.

A model town has been built within the city limits of Duluth, by the Minnesota Steel Company, in connection with its new steel works in that city. The town includes water supply and sewerage systems, concrete paved streets, about one hundred and forty residences, a hospital and a school.

A series of tests to determine the strength of glue were made by Messrs. O. Linder and E. C. Frost, and reported to the recent meeting of the American Society for Testing Materials. The results show a strength of from 1100 to 1950 lb. per sq. in. for a glue made of 1 part dry glue and 3 parts water, and a strength of 60 to 70 per cent. of the above figures for a 1:5 glue. Prolonged heating lowers the strength of the glue. Glue solutions heated to 150 deg. F. for 20 hours showed a loss of 30 to 45 per cent. in strength.

Students of the leading engineering schools have been offered an opportunity to compete for $1,000 in prizes for essays on highway construction. The subjects suggested cover a wide range, including—factors which should govern the choice of types of pavements and roads and the materials used therein; an ideal paving program for a city of 25,000; economics of highway construction, and half a dozen related topics. The prizes are offered by The Barber Asphalt Paving Company to promote investigation of highway problems by engineering students and to encourage them to enter a field of work where there is great need for trained men.

Of the new uses for concrete the latest is in the building of a ferry landing at Sydney, Australia, where a big pontoon made of reinforced concrete was adopted. It is 100 ft. long, 68 ft. wide at one end and 43 ft. at the other, and 7 ft. 9 ins. deep, giving it a freeboard of 32 ins. The bottom is flat, and the ends are given an inclination of 70 deg. The pontoon is divided into 48 watertight compartments, and is carefully reinforced so as to withstand the pressure of vessels lying alongside. A live load of 150 tons is provided for, and the structure weighs 650 tons. It is expected that this concrete structure will require little attention to the way of repairs, will be permanently watertight and will overcome many other troubles to which the ordinary wooden or steel pontoons are subject.

Asbestos and Portland cement for many years have proved good partners in fireproof construction and property protection. A new building material is just being turned out in Switzerland where large [illegible] boards are made under pressure, with Portland cement and asbestos fibre, forming the principal ingredients. The slabs, 1-in. thick and about 4 ft. by 15 ft. in area, may be cut as desired at the factory and are adapted for outside walls, inside finish, certain furniture and many other uses. Cement and asbestos have for many years been used with admirable results in making shingles and for other similar purposes and the short-fibre asbestos which is to a cetrain extent a by-product of the production of the high grade, long fibre asbestos, capable of being spun, finds its way when mixed with Portland cement into many uses in the line of building construction.

The problem of economical distribution of concrete for long and comparatively low structures, such as arches and viaducts, is frequently solved by the use of long gravity chutes running from high hoisting towers to the points of deposition.

The Department of Trade and Commerce, Ottawa, is advised that a company has been formed in Sydney, New South Wales, for the purpose of manufacturing asbestos in Australia, and that they are erecting works for that purpose. As they will require crude asbestos they have inquired as to the source of supply, freight rates and other particulars concerning Canadian asbestos. They are contemplating sending a member of their firm to Canada to study the situation. It has been suggested that they might wish to begin by importing manufactured asbestos goods, and that with this in view they might desire to get into touch with Canadian producers of these goods. It is hoped, therefore, that Canadian asbestos manufacturers will follow up this notice by communicating with the firm in question—the name and address of which may be had on application to the Department of Trade and Commerce, Ottawa—and that this may result in the establishment of a permanent trade connection.

Mr. E. L. Warner, lately appointed Eastern representative of the Dominion Paint Works, Limited, Walkerville, Ont., has removed from Transportation Building, to larger quarters in the Eastern Townships Bank Building, Montreal. His head office is in the Lumsden Building, Toronto.

A bulletin received from Mr. C. R. Young, Chairman of the Library Committee of the Toronto Branch of the Canadian Society of Civil Engineers, directs attention to recent additions to the library in the way of Transactions, Proceedings, Journals, Reports, Engineering Treatises and Text-Books. A printed catalogue of the whole library is to be prepared and distributed in the near future. Members of the Branch are invited to consult the complete card catalogue which may be seen at Headquarters, 90-96 King Street West.

The Canadian Billings & Spencer and the Canada Forging plants are now working to limit. These two plants were consolidated as the Canada Foundries & Forgings, Limited, a few years ago. Industry showed a falling off during the first half of the present year, but during the last couple of months there has been a sudden accession of orders which has taxed the capacity of the plants. It is stated that the orders on hand at present represent more, both in bulk and in money, than the entire output of 1913. Many of the orders are on account of the Dominion and Imperial Governments, portions of the Ross rifle being manufactured here. One of the plants also has been working on heavy shells for the Imperial Government.

Personal Mention

Mr. J. J. McNiven has been appointed assistant inspector of gas and electricity for the City of Vancouver.

Mr. R. A. Ross, consulting engineer, Montreal, is acting for the City of Peterborough, Ont., in its negotiations for the acquisition of the plant of the Peterborough Light & Power Company.

Mr. Herbert S. Hersey, General Manager of the C. O. Bartlett & Snow Company of Canada, Limited, Montreal, is reported as improving daily following an optical operation on October 20th.

Mr. C. A. Lee is scheduled to read a paper, "Jordan River Power Development, Vancouver Island," before the Vancouver Branch of the Canadian Society of Civil Engineers on November 19.

Mr. R. S. Gillette, previously connected with the Sanitary Tiling Company, has opened offices at 809 Eastern Townships Bank Building, Montreal, as the Canada Tile Company, tile contractors and associated lines.

Mr. Thos. Adams, town planning expert to the Commission of Conservation, delivered an address at Berlin, Ont., last week. The municipal councils of Berlin and Waterloo attended. The meeting was held under the auspices of the Berlin Civic Association.

Mr. Gordon B. Johnson, Canadian Trade Commissioner at Yokohama, Japan, an engineering graduate of the Royal Military College, Kingston, has volunteered for active service and has been accepted by the Imperial Government. He is now on his way to England.

Mr. C. S. L. Hertzberg, of the Trussed Concrete Steel Company, writes us from Walkerville stating that he has not volunteered for active service abroad. In our issue of November 4 we published a list of members of the Canadian Society of Civil Engineers who had gone on active service with the Canadian Expeditionary Force. This list contained the names of Mr. C. S. L. Hertzberg and Mr. H. F. H. Hertzberg. The latter only should have been included.

Dr. J. A. L. Waddell and Mr. John Lyle Harrington announce the dissolution of the firm of Waddell & Harrington, Kansas City. The firm's business will be conducted as usual until the conclusion of its affairs in July, 1915, except that it is accepting no new commissions. Dr. Waddell will give his attention to special engineering and financial matters and to important advisory work. Mr. Harrington will be joined by the firm's Associate Engineers, Mr. E. E. Howard and Mr. Louis R. Ash, in the establishment of the firm of Harrington, Howard and Ash.

The following gentlemen have been nominated for officers and members of Council of the Canadian Society of Civil Engineers for 1915, as submitted by the nominating committee: For president, F. C. Gamble; for vice-president for three years, A. E. Doucet and A. St. Laurent; for vice-president for one year, E. E. Brydone-Jack and Gordon Grant. For Councillors—Ditsrict No. 1, S. P. Brown, H. R. Safford, A. Surveyer, R. M. Wilson; District No. 2, C. B. Brown, F. W. W. Doane; District No. 3, A. Amos, T. A. J. Forrester; District No. 4, G. J. Desbarats, A. J. Grant; District No. 5, S. B. Clement, J. L. Weller; District No. 6, W. G. Chace, F. H. Peters; District No. 7, N. J. Kerr, D. O. Lewis. With the exception of the nomination for President, two members are proposed for each office. The officers to be elected are a president, a vice-president for the full term of three years, a vice-president for a term of one year, two members of council representing District No. 1 and one member of council for each of the other districts.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

At Ottawa, paving work estimated to cost $114,000 has been commenced on Preston Street between Carling and Wellington Streets.

Announcement is made that the Steel Company of Hamilton will re-open one of their furnaces on November 20, employing one hundred men.

The Jeffrey Manufacturing Company, Montreal, have removed their office to 425 Power Building. The warehouse will remain at 55 Cote Street.

The Interprovincial Brick Company, Limited, Toronto, have secured the entire face brick contract for the Proctor & Gamble plant at Hamilton.

The Associated Cement Company (Canada), Limited, has been incorporated at Ottawa. It is reported that Messrs. Mackenzie & Mann are behind the new firm.

Tenders for street railway equipment to cost $130,000 have been awarded to the Canadian General Electric Company, Toronto, by the London & Port Stanley Railway Company.

The Ottawa City Council has passed a by-law for the expenditure of $250,000 on the construction of an intake. The work is to be started at once. Mr. R. L. Haycock is the Engineer.

The Toronto City Council have approved the construction of a new street railway line on Bloor Street from Dundas to Quebec Avenue. The estimated cost of the work is [illegible].

The Barton Sand & Gravel Company, Hamilton, Ont., has been incorporated with a capital of $100,000. Those interested in the new enterprise include Dr. E. A. Alway, of Bartonville, Ont.

Work has started on the Port Credit and Burlington sections of the new concrete highway between Toronto and Hamilton. The estimated cost of the undertaking is $600,000. Mr. H. S. Van Scoyoc is the Engineer.

At Hochelaga (Montreal), the new school building which is being erected for the School Commissioners is progressing rapidly in its construction. The architects are Messrs. Viau & Venne, and the general contractor is Mr. J. A. Durocher.

The Mimico, Ont., Council have decided to submit a by-law authorizing the construction of water and sewerage systems for the village. Plans for the work have been prepared by Mr. E. A. James. The work is estimated to cost $125,000.

From Owen Sound, Ont., comes the report that Mr. R. H. McWilliams of Owen Sound and Mr. John Russell of Toronto, have purchased about [illegible] of the gravel area at [illegible] Island, where they will engage in the manufacture of cement.

Negotiations have been completed for the construction of a pipe-line to supply St. Catharines, Welland, Merritton and Thorold direct from Lake Erie. Tenders for the work are to be called shortly. The estimated cost of the undertaking is $1,000,000.

The contract has been signed for the Park Avenue subway at Montreal and work is to start immediately. The engineer in charge is Mr. J. Emile Vanier and the general contractors are Messrs. [illegible] & [illegible]. The estimated cost of the undertaking is $176,000.

Work has started on the new physics building at the Ontario Agricultural College, Guelph. The structure will be 100 feet x 65 feet in size, three storeys high, and will cost about $50,000. The building fund is a portion of the Federal grant to Ontario for agricultural purposes.

Work has been completed on the new Government dock at Belleville, Ont., by the Randolph Macdonald Company of Toronto. The contract called for concrete work. The wharf is extensive, projecting far out into the Bay of Quinte. Dredging work has not yet been completed.

The gratifying announcement is made that the Massey-Harris Company will re-open its works in Toronto and Brantford on the first of December. The company expect a great demand for their implements next spring as a result of the stimulus to farming in Western Canada created by the war.

Plastering is in progress on an apartment block at Port Arthur, Ont., estimated to cost $100,000, for Port Arthur Buildings, Limited. The building is to be of terra cotta, reinforced concrete and brick construction. The architects and general contractors are Messrs. Marsh, Hutton & Powers Company, Limited.

Exterior work is advancing rapidly on the new office building which the Liverpool, London & Globe Insurance Company are building on Dorchester Street West, Montreal, at a cost of $175,000. The architects are Messrs. Nobbs & Hyde and the general contractors are Messrs. E. G. M. Cape & Company, both of Montreal.

It is proposed that the city of Montreal form a department for the inspection of all electrical work. This work has hitherto been done by the Canadian Fire Underwriters' Association, which has now incorporated a separate company—the Canadian Underwriters' Electrical Inspection Bureau, Limited,—to take over this part of the business. The city law department will report on the city's powers to establish a department.

Notwithstanding war conditions, things appear favorably with the Cheticamp Gypsum and Plaster Company, Limited, according to the reports of Mr. James Brodie, who is on a trip to the company's properties at Eastern Harbor, C.B. Although the quarry output has been taken by American Plaster Mills for the next five years, new rolling stock and equipment, such as steam shovels, locomotives, dump cars, etc., is being added. The company markets all its manufactured plaster in Canada. The machinery is on the ground and will be installed this winter. As a result the output will be increased very largely.

Another effort is to be made to remodel the Montreal building by-laws, which have been under consideration for several years. A committee consisting of Messrs. Francis and Venne spent many months in revising the code, but this has failed to meet with approval, as portions of the code conflicted with other municipal regulations. It has therefore been decided to submit the entire matter to a special committee of the Civic Legislature Committee—Messrs. A. Chausse, building inspector; the City Clerk, Ald. Lapointe, and the city attorney, Messrs. Francis and Venne being invited to consult with the special committee.

WESTERN CANADA

The Calgary City Council is making arrangements to appoint a special committee to deal with the question of city planning.

At West Burnaby, B.C., an eight-room school building is to be erected at a cost of $50,000. Plans are being prepared by Mr. J. H. Bowman

The third annual convention of the British Columbia members of the Canadian Society of Civil Engineers is to be held at Victoria, B.C., December 11-12

Application for authority to carry out the construction of the [illegible] Peace River Railway will be made at the next session of Parliament by the Peace River and Athabasca Railway Company.

The new building which has been erected on Qu'Appelle Avenue, Winnipeg, for the Knox Presbyterian Church, at a [illegible] cost of $225,000, has reached the roofing stage. The architect is Mr. J. H. G. Russell, and the general contractors are Messrs. Jas. McDiarmid & Company, both of Winnipeg.

Fort George, B.C., reports activity in building work. During the last three months residential and business buildings to the value of $500,000 have been erected. The value of the work at present under way is $250,000. The largest work now under construction is that for the Grand Trunk Pacific Railway.

The extensions to the White Valley irrigation system will be completed in about five weeks. The work is under the supervision of Messrs. Ducane, Dutcher & Company, Vancouver. Next spring further extensions and revisions will be started, at an estimated cost of about $100,000. The entire system has cost $550,000.

The new bank building which the Merchants Bank of Canada are erecting at Calgary at a cost of $122,000 is nearing completion. The building is three storeys high, of steel and brick construction, with a stone and granite front. The architects are Messrs. Brown & Vallance, of Montreal, and the general contractors are Messrs. Carter-Halls-Aldinger Company, of Winnipeg.

At Calgary, operations are about to be commenced on the new warehouse and office building for the Western Canada Cordage Company. Four buildings will be erected at present—the main building, fibre warehouse, machine shop and office building. The architect is Mr. Chas. Hay, and the general contractors are Messrs. Thomas-Jamieson & McKenzie, both of Calgary.

The Grand Trunk Pacific Railway has let contracts for the construction of buildings at four of its divisional points along its main line in British Columbia. Buildings will be erected at Endako, Smithers, Prince George and Pacific at a cost of $300.000. Twelve-stall roundhouses will be erected at each town. Contracts to build machine shops, stations and warehouses at Prince Rupert will shortly be let.

Mr. J. W. Stewart, president of the Pacific Great Eastern Railway, announces that construction is proceeding with undiminished vigor all along the route of the new line from near Pemberton to Fort George, B.C. A force of nearly 7,000 men is engaged in the task of projecting a new line into the interior. A sum aggregating between $1,250,000 and $1,500,000 is being spent each month in the work of construction.

Work on the construction of five oil tanks for the Imperial Oil Company has been commenced at Prince Rupert, B.C. The erection of the tanks will be rushed to completion. Two pump houses and a warehouse, 50 x 150 feet, will also be built. The site is located near the dry dock, and will require considerable excavating. The storage plant to be constructed at Prince Rupert for the Imperial Oil Company will cost $250,000.

The Railway Department of the Provincial Government, Victoria, B.C., have received advices that nearly a mile and a half of the preliminary shaft of the five-mile tunnel to be driven under the Selkirk Range for the C. P. R. has been excavated. On October 26, 5,014 feet had been excavated out of the pioneer bore, a small passage running parallel to the main tunnel from the western portal. Rapid progress is being made with the main tunnel, which is designed for double-track traffic. The main heading has been widened out to its full width, 2,363 feet from the eastern end of operations, and 1,256 feet from the western entrance. A section 706 feet long has been completed at the east end.

It is announced that the Grand Trunk Pacific has entered into contracts with Messrs. Carter-Halls-Aldinger Company for the construction of terminal buildings at Prince George, Endako, Smithers and Pacific, four thriving divisional points on their main line. This work will take care of a very large number of mechanics and laborers during the coming winter season. The works are to be extensive and ample for the anticipated needs of the next few years, and include roundhouses, machine shops and so forth. In addition, it is probable that a contract will be let for the works at Prince Rupert, the coast terminus, within a short time, and in further addition to these works the company are also constructing a large number of warehouses, stations and other buildings at the divisional points.

Dr. Alfred Thompson, member of the Dominion Parliament from the Yukon, who is active in the development of the district which he represents, makes the announcement that railway communication between northern British Columbia, Yukon, and Alaska will follow the completion of the Canadian Northern Pacific and the operation of the Grand Trunk Pacific Railways. It is Dr. Thompson's belief that the next great railway to be constructed in Canada will be from a point on the Grand Trunk in British Columbia through the northern part of the Province and the Yukon to connect with the system which is to be built by the United States Government in Alaska. This will open up a vast territory in northern British Columbia and southern Yukon, and give railway communication from Sydney to the boundary line of the Yukon on the one hundred and forty-first meridian west, making it possible to take a train in Vancouver and ride to the shores of Bering Sea. This will make an empire tributary to the cities of British Columbia, with Vancouver as the railway and commercial centre. The Yukon has large areas of fine agricultural land, and the gold production of the territory for the last year is estimated at $6,000,000. The plan of the United States Government to spend $35,000,000 in railroad construction in Alaska will give impetus to the building of connecting lines in British Columbia and Yukon, and will result in opening and developing much valuable territory rich in natural resources.

Book Reviews

Concrete-Steel-Construction (Part 1) Eddy & Turner, Minneapolis. This work is a treatise upon the elementary principles of design and execution of reinforced concrete work in buildings. The authors point out that the fire losses in Canada and the United States amount annually to half a billion dollars and that the question of economy governing the type of construction it is a matter of the greatest importance to determine whether safe fireproof buildings can be built at practically no greater cost than combustible ones. In their book the authors discuss the practical problems of reinforced concrete, and treat at length the restraint imposed upon the elements of the composite structure, so that rational rules may be adopted for the safe and economic design of this type of fireproof building. The following statement is borne out by the experience of many Canadian towns and cities: "Failure on the part of the engineering profession to consider these laws in drawing up building codes has led to grave errors, thereby offering a premium on the more dangerous types of designs in concrete building work, and placing at a disadvantage the more scientific, safe, and conservative types of work as determined by the records of these types in practical construction." Patented as well as unpatented types are discussed, and engineers cannot fail to find special interest in the treatment of steel ratios and flat slabs by the theory of work and in the section devoted to reinforced concrete columns. The book contains upwards of four hundred pages and is illustrated by numerous halftones and diagrams.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Empress, Alta.

A by-law has been passed by the town council in favor of the construction of a water-works system for the town at an estimated cost of $66,000. The scheme is to supply the town with water from Red Deer River power plant, at a cost of $16,000; reservoir $6,000; 10-in. water main to town, $33,000; distributing system, $11,000. The John Galt Engineering Company are the engineers. Mr. E. L. Miles, 233 Judge Travis Building, Calgary, is the manager.

Grimsby, Ont.

A by-law will be submitted to the ratepayers here for the construction of water mains on Maple & Livingston Avenues and Clark and Paton Streets, at an estimated outlay of $12,000. Mr. Jas. Brodie is the town clerk.

Halifax, N.S.

Tenders will be received by Mr. E. H. Armstrong, Halifax, until November 25th for excavating and placing culverts and erection of arches in Colchester County, for the Provincial Government Department of Public Works. Plans and specification are at offices of Mr. Wm. McKenzie, Earltown; McLeod & McLean, Denmark Station; David Nelson, Tatamagouche; Walter Byers, New Annan, and John L. Hingley, Kempton. Mr. H. F. Donkin is the engineer.

Ingersoll, Ont.

The town council will submit a by-law to the ratepayers shortly for authority to carry out paving work, etc., on Thames Street, with cement curbs and gutters. Mr. W. A. Smith is the town clerk.

Morris, Man.

The Municipality of Morris have made arrangements to expend $4,000 on the carryng out of drainage work this year. Mr. D. M. Ure is the clerk.

North Dorchester Twp., Ont.

Tenders will be received bp Mr. W. B. Lane, Dorchester Station, Ont., clerk, until noon November 30th for the construction of Piney Creek drain. Plans and specification are at office of clerk or Mr. C. A. Jones, O. L. S. Petrolea.

North Easthope Twp., Ont.

The township council is constructing a drain to be known as Krampien drain, starting on lot 10, con. 8, having its outlet in the Township of Wilmot. Tenders for the work will be received by Mr. J. D. Fisher, R. R. No. 1, Stratford, until 2 p.m. November 25. Plans and specification are at office of clerk and also Mr. John Rogers, O. L. S., Mitchell.

Niagara Falls, Ont.

The Provincial Government has authorized the city council to make an over-draft in order that paving work may be carried through this winter. Mr. J. Seymour is the city clerk.

Oakville, Ont.

The town council has authorized the Water, Power & Light Commission to proceed with extension to water system into Pine District suburb. Mr. Wm. E. M. Crawley is the town clerk.

Ormstown, Que.

Tenders will be received by Mr. J. C. Bryson, secretary-treasurer, parish of St. Malachie d'Ormstown, until 1 p.m. November 20th, for the construction and macadamizing of the following roads:—(1) S. side Chateauguay River, 3½ miles; (3) Cairnside By-road, 2¼ miles; (2) N. Side Chateuguay Road, from Village to two miles west; (4) Jamestown By-road, 2½ miles; (5) Ormstown side road, one mile. Each of the above must have a separate tender. Contractor to furnish all machinery and material. Plans and specification are at the council office.

Ottawa, Ont.

Work on the construction of $60,000 sewerage system, including the laying of tile and brick sewers, will be done by day labor under the supervision of Mr. R. L. Haycock, sewerage engineer.

Pembroke, Ont.

Waterworks extensions consisting of 3,000 ft. of 6-in. cast iron water mains with special valves and hydrants are to be laid this year by the town council. Work will be done by day labor. Mr. W. J. Moore is the engineer and Mr. H. J. Fortier is the town clerk.

Regina, Sask.

The city council has awarded the following contracts in connection with sewage disposal works here:—General contract, Canada Iron Corporation, Montreal, for supply of 2 12-in. ¼ bends, 2 12-in. off 18-in. tees, 22 12-in. lengths 18-in. c.i. pipe; Drummond, McCall & Company, Winnipeg, 1 18-in. gate valve with 7 ft. key, 2 12-in. gate valves with 7 ft. key and valve box.

Thorald, Ont.

Bids will be received by Mr. Jas. Wilson, chairman, town council, until 8 p.m., November 25, for the construction of a complete water filtration plant. Plans and specification are at office of chairman and also of the engineers, Messrs. Chipman & Power, Mail Building, Toronto.

Toronto, Ont.

Tenders close on November 24th for the carrying out of sewer work on 11 streets and Alton Avenue drainage system outlet. Plans, etc., are at sewer department, city hall.

Winnipeg, Man.

Tenders will be received by the chairman, board of control, until 11 a.m. November 19, for the construction of sewer connections and installation of plumbing to private properties. Plans and specification are at office of engineer, Mr. W. P. Brereton, 223 James Avenue, Winnipeg.

CONTRACTS AWARDED

Ethel, Ont.

The general contract for the construction of [illegible] Creek drain has been awarded by the Township of Grey to Mr. August Guhr, Seaforth, Ont. The estimated cost is $23,000. Work will be started next spring.

Halifax, N.S.

The general contract for trenching and laying 2,600 ft. of 18 in. x 24 sewer pipe and 1,200 feet of 6-in. water mains has been awarded by the city council to Messrs. Geo. Lowe and Company, Metropole Building, at $13,800. Mr. F. W. W. Doane, city hall, is the engineer.

London, Ont.

The Board of Control has let the general contract for the construction of sanitary sewer on Adelaide Street, from Oxford to St. James Street, to Mr. W. G. Webster, Bank of Toronto Building, at $1,991. Mr. Wm. Ashplant is the engineer.

Toronto, Ont.

The following contracts for sewer construction have been awarded by the Board of Control (Mr. R. C. Harris, City Hall, Commissioner of Works):—Fussel-McReynolds Company, Main Garrison Sewer, No. 5, $41,644; Mr. R. J. Moyers, Wolverleigh, $948; Mr. W. E. Taylor, Stacey, $972; Lane, $243; Hillington, $2,087; Messrs. McLaren & Company, Barrington Avenue, Drayton , $1,878, Oakdene, $695; Messrs. Wilkes & Wallace, Rosehill, $[illegible]; Messrs. Stephens Darrigo & Company, Glebeholme, $1,-390, Milverton, $1,400.

Railroads, Bridges and Wharves

Montreal, Que.

The contract for construction of subway on Park Avenue at $176,176 has been signed under new terms and work will start immediately. Mr. J. Emile Vanier is Engineer-in-Charge, and Messrs. Laurin & Leitch are the general contractors.

Prince George, B.C.

Work has started on the construction of 12-stall roundhouse and machine shop for the Grand Trunk Pacific Railway. The building will be brick and steel construction, felt and gravel roofing. Messrs. Carter-Halls-Aldinger Company, Winnipeg, are the general contractors. Mr. J. G. Legrand, Union Station, Winnipeg, is the engineer.

Pacific, B.C.

The construction of a 12-stall roundhouse and machine shop, brick and steel construction, felt and gravel roofing, for Grand Trunk Pacific Railway, Winnipeg, is started. Messrs. Carter-Halls-Aldinger Company, Winnipeg, are the general contractors.

St. Catharines, Ont.

Mr. J. A. Pay, City Clerk, will receive tenders until December 8 for erection of bridge superstructure on St. Paul Street. steel construction, 1,236 ft. long, 41 ft. wide, 44 ft. high. Approximately [illegible] lbs. of steel will be required. Plans and specification may be seen at office of engineer, Mr. W. P. [illegible]

Toronto, Ont.

Tenders close December 21 for contract to construct bridge across Rosedale Valley, 86 ft. wide, one steel arch span, with piers and bridges, total length, 580 ft., retaining wall 170 ft., constituting Rosedale section Bloor Street Viaduct. Designs and tenders on concrete construction may be submitted as an alternative to steel. Plans and specifications are at office of Commissioner of Works, Mr. R. C. Harris, City Hall; Commercial Intelligence Department, Board of Trade, London, Eng.; office of "Engineering," London, Eng.; "Engineering News," New York City; Engineering and Contracting Company, Chicago.

Victoria, B.C .

The city council has in contemplation the reconstruction of Rock Bay Bridge. Instructions have been given to the city engineer to make a report. Mr. Wellington J. Dowler is the city clerk.

Public Buildings, Churches and Schools

Brantford, Ont.

The city council will call for tenders in about two weeks for the contract to construct one-storey 35 x 45 Small-pox Hospital, concrete foundation, brick construction, at Mount Hope cemetery, at an estimated cost of $4,000. Messrs. Barber & Tilley, Temple Building, are the architects.

Cobalt, Ont.

In connection with structural addition to School for Public School Board at an estimated cost of $6,210, the contract for interior fittings has not yet been let. Angus and Angus, Main Street, North Bay, are the architects. Mr. Judson Brown, Cobalt, has the general contract.

Edmonton, Alta.

The school board has secured a site on Delton Subdivision upon which to erect a temporary school. The contract has not yet been let. Mr. Brady, 4 Mortlake Block, is secretary.

Greenwood, B.C.

Interior fittings have not yet been installed in new $41,000 Post Office which is about completed for Dominion Government Department of Public Works. Mr. R. C. Desrochers, Ottawa, is the secretary. Messrs. John Benmis & Son, are the general contractors.

Huntsville, Ont.

The Dominion Government Public Works Department will erect a Post Office here next year.

London, Ont.

Tenders for heating and interior fittings have not yet been let in connection with the $25,000 church on Ridout Street. Mr. J. V. Munro, Bank of Toronto Chambers, is the architect. Messrs. Hyatt Bros., are the general contractors.

Montreal, Que.

Tenders for separate trades will be called almost immediately in connection with the construction of three flats on Visitation Street, three-storey, 33 x 85, concrete foundation, brick construction, at an estimated cost of $15,000 for Mr. L. Belanger, 700 St. Catharine Road. Mr. Raoul Gariepy, 25 St. James Street, is the architect. Tenders will be received by him.

Tenders are closed and contract will be awarded in December, when work will proceed, on construction of $90,000 Synagogue on St. Urbain Street for The Adath Eshroon. Mr. W. L. Vandal, 202 Main Building, St. Lawrence Street, is the architect. Mr. M. Fromson, 68 Colonial Avenue, is secretary building committee.

Notre Dame de Grace, Que. (Sherbrooke)

In connecton with the construction of $400,000 building for Loyola College, the sub-contract for plastering has not yet been let. The architects are Messrs. Pedan & McLaren, 20 St. Alexis Street, and the general contractors are Messrs, Anglins Limited, 65 Victoria Street.

Oakville, Ont.

The ratepayers here will vote on a by-law on December 7 to raise $10,000 for the erection of a fire hall. Mr. W. E. Crawley is the town clerk.

Ottawa, Ont.

Plans are in progress for repairs to Aberdeen Pavilion, Lansdowne Park, estimated to cost $22,000. Building will be brick construction. Mr. W. E. Noffke, 45 Rideau Street, is the architect.

Tenders will be received by Mr. W. E. Noffke, 45 Rideau Street, architect, until November 23rd, for Furnishing and Seating Church on McKay Street, estimated to cost $20,000. Tenders are in for other trades than masonry, which is being done by day labor. No contracts have yet been awarded. Building will be brick construction. St. Paul's Lutheran Church are the owners.

Preston, Ont.

Tenders will be received by Mr. R. C. Desrochers, Ottawa, until 4 p.m. November 30 for the supply of fittings, including screens, furniture, drawers and counters in connection with new post office for the Dominion Government Department of Public Works. Plans and specification are at offices of Mr. J. H. Mickler, Clerk of Works, Preston, Ont.; T. A. Hastings, Clerk of Works, Postal Staton "F," Toronto; and at Department, Ottawa. Specification at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Pembroke, Ont.

Pembroke General Hospital Board is constructing an addition of gallery to Hospital, reinforced concrete construction, metal sash, estimated cost $5,000. Messrs. Archambault & Company, 332 Bleury Street, Montreal, are the general contractors.

Picton, Ont.

A by-law will be submitted at next meeting of the town council to authorize the construction of Town Hall here. If by-law passes work will proceed without delay. Mr. R. MacNee, Box 172, is the town clerk.

South Edmonton, Alta.

Work has re-commenced on University Campus, estimated to cost $450,000, for University of Alberta. Messrs. Geo. A. Fuller Company, Limited, are the general contractors. Mr. Burgess, University of Alberta, is the architect.

St. Marys, Ont.

Additional seating for Public Schools will be purchased by the Board of Education. Mr. W. H. May, c/o White & May, is the chairman.

Shediac, N.B.

The sub-contract for painting $50,000 church, sandstane construction, in course of erection here for the R. C. Denomination, has been awarded to Messrs. Allan & McDonald, Moncton, N.B. Mr. R. A. Frechet, 30 Bonnacord Street, Moncton, N.B., is the architect.

St. Felicien, Que.

The sub-contract for painting has not yet been let in connection with $125,000 church in course of construction for the Parish of St. Felicien. Building is 212 x 75 ft., stone construction. Mr. Jos. Pouellet, 28 Ste. Famille Street, is the architect. Mr. E. Tremblay, St. Felicien, is the general contractor.

St. Leon, Que.

All sub-contracts except interior fittings and electrical work have been awarded in connection with $50,000 addition to Church for parish of St. Leon. Messrs. Ouellet & Levesque, 115 St. John Street, Quebec, are the architects. Mr. Jos. Couture, Levis, is the general contractor.

Toronto, Ont.

The Property Committee of the Board of Education have approved of sketch plans for addition to school building on Regal Road. Mr. W. C. Wilkinson is the secretary-treasurer.

Welland, Ont.

The contract for remodelling interior and installing 500 additional letter boxes, etc., in the new post office here, has been awarded to Messrs. Ryan & Gardiner, Welland, at $1,200. Letter boxes will be supplied by the Government and are not included in contract price.

CONTRACTS AWARDED

Fort George, B.C.

Work will be started immediately on the construction of $8,500 school for Provincial Government Department of Public Works. Mr. W. G. Gillett, Fort George, has the general contract.

Hamilton, Ont.

The following contracts in connection with the construction of $20,000 Lodge Hall on Hughson N., for Sons of England, have been let:—Mason, Hancock Brothers; carpentry, Mr. Chas. Gleadow. Building will be four-storeys, 37 x 45, steel and brick construction. Messrs. F. J. Rastrick & Son, 30 King E., are the architects.

The following additional contracts have been let in connection with addition and alterations to Hospital on Barton Street:—Sewers, Messrs. J. J. Armstrong & Son; glass, Messrs. Leeks & Potts, $287; iron work, stairs, Mr. R. G. Olmstead, $3,241; coal and ash pockets, Mr. R. Tope, $3,756. Building is estimated to cost $100,000. The architects are Messrs. Stewart & Witton, 7 Hughson Street S.

Moose Jaw, Sask.

The contract for post office fittings for new Post Office building on Fourth Avenue and 23rd Street, has been awarded to the Office Specialty Manufacturing Company, Regina. The building will be completed early next year.

Ottawa, Ont.

The sub-contract for electrical work on $75,000 bank for Royal Bank of Canada, Sparks Street, has been awarded to Messrs. Spencer & Aspinal, Limited, Ottawa. Tenders will be called later for carpentry, roofing, plastering and painting. Building will be 90 x 75, terra cotta construction. Mr. K. G. Rae, Guarantee Building, Montreal, is the architect. Messrs. Purdy and Henderson, New Birks Building, Montreal, have the general contract.

Quebec, Que.
Sub-contracts have been let as follows in connection with the construction of Bank and Offices on St. Peter and St. Paul Streets, to cost $90,000, for the Canadian Bank of Commerce:—Painting, Messrs. Marier & Tremblay; heating and plumbing, Messrs. W. J. McGuire & Company, Limited, Montreal; Sutherland Construction Company, Ryrie Building, Toronto, are the general contractors; Dominion Realty Company, 34 King W., Toronto, are in charge of the architectural work.

Business Buildings and Industrial Plants

Calgary, Alta.
Four buildings for warehouse and office accommodation are to be erected for the Western Canada Cordage Company. The main building will be 160 x 140 ft., fibre warehouse 160 x 80 ft., machine shop 120 x 40 ft., office 30 x 60 ft. Complete machinery for rope and twine making will be installed. The architect is Mr. Chas. Hay, 202 Oddfellows Building. The general contractors are Messrs. Thomas-Jamieson & McKenzie, 307 Judge Travis Building, Calgary.

Elkfrid Township, Ont.
The erection of farm buildings, fireproof construction, concrete and stone foundation, at an estimated cost of $3,000 is contemplated by Mr. Albert Gates, Con. 5, Elkfrid Township, Glencoe P.O. Flooring and roofing are to be selected.

London, Ont.
Plans are in progress for alterations to stores and office, 326 Dundas Street, for Messrs. A. Hartman and H. Shobsove, 300 Dundas Street. Owners have purchased Y. M. C. A. property, which will be altered to provide two stores and offices. Alterations will include new metal store fronts, stairway, tile entrance, hardwood floors, plate glass, steam heating, painting and decorating. Mr. J. V. Munro, Bank of Toronto Chambers, is the architect.

Malahide Township, Ont.
The erection of $3,200 farm buildings here, fireproof construction, stone and concrete foundation, for Mr. S. H. Kennedy, Aylmer P.O., Ont., is contemplated.

Ottawa, Ont.
Plans are in progress for the roofing of main and dairy buildings and brick [illegible] wooden building at the Exhibition Grounds. Estimated cost $3,000. Mr. Norman H. Lett is secretary.

Tenders on plastering, painting, heating, plumbing and electrical work are being received by Mr. E. J. Durocher, [illegible] Street, in connection with the construction of $20,000 store and apartments on [illegible] Street, [illegible] brick construction.

Port Alberni, B.C.
The construction of a shingle mill is contemplated here by Mr. [illegible]. Erection of mill will be started next spring.

Preston, Ont.
The "Del Monte" hotel here has been purchased by Mr. S. Garfunkel, 316 Bathurst Street, Toronto, at [illegible]. [illegible] alterations are in contemplation.

Pembroke, Ont.
A factory and dry kilns, frame and brick construction, concrete foundation, for the manufacture of box shooks, is being erected by the H. & H. Box Company, (J. T. Stuart, Mgr.), Messrs. Wm. Markus & Company are the general contractors.

Port Stanley, Ont.
A by-law will be submitted to the ratepayers of Port Stanley next January to authorize the raising of $5,000, half the cost of a proposed railway station to be undertaken jointly by the town council and the London and Port Stanley Railway Company, London.

Quebec, Que.
The show factory owned by Messrs. Gale Bros., 518 St. Valier Street, has been burned down. Loss $25,000, mostly insured. Owner will rebuild at once and purchase all machinery.

Regina, Sask.
Only a temporary building in connection with the proposed $6,000 Labor Temple for Regina is being erected at present by day labor under the supervision of the secretary, Mr. W. E. Cook, 1853 St. John Street.

Stratford, Ont.
Loss estimated at $30,000 on building, machinery and stock has been sustained through the destruction by fire of the Classic Furniture Company's factory.

St. Catharines, Ont.
The St. Catharines Silk Mills, Limited, have leased premises for silk manufacturing, storage and shipping. The company may build mills later. Mr. F. L. Kromer is the manager.

Ste. Brigide, Que.
The grist mill owned by Mr. D. E. Menard, has been destroyed by fire. Loss estimated at $9,000 was insured. Owner will rebuild. Machinery will be required.

Shannonville, Ont.
Evaporator plant occupied by the Graham Company, Belleville, has been destroyed by fire. The loss is estimated at $3,000; insurance $2,500. Mr. Wm. Elliott is the owner.

Summerside, P.E.I.
The Sash and Door Factory owned by Messrs. M. T. Schurman & Company has been destroyed by fire. Loss, estmated at $6,000, is partially covered by insurance.

Toronto, Ont.
A new factory, two-storeys and basement, 150 x 50, mill and brick construction being erected on Dufferin and Van Horne Streets, will be occupied by Maples Limited, manufacturers of syrups, etc. The engineers and general contractors are the Standard Structural Company, Manning Chambers.

Sketch plans are being prepared for fireproof brick building to replace the Humber Beach Hotel, Humber Bay, which was burned down recently. Mr. Jos. Cosgrave is interested in the project. The manager is Mr. Connolly.

Alterations including new store fronts, one-storey, 20 x 26, brick construction will be carried out shortly by Mr. E. [illegible] in connection with store on [illegible] Avenue. Mr. Chas. [illegible], [illegible] Harvie Avenue, has the general contract at [illegible].

Welland, Ont.
The Candied Fruits Confectionery Company, Limited, have secured a site for the erection of a candied fruit factory at [illegible] Park at an estimated cost of $40,000. Work on erection of plant will be commenced next spring, providing sufficient shares can be disposed of in the meantime. Mr. Geovanni Danovaro, 260 Main Street, is reported to be interested in the project.

Waterdown, Ont.
Some equipment may be purchased in connection with addition to jam factory for the Westworth Orchard Company.

Residences

Ottawa, Ont.
Prices on plastering, painting, heating and plumbing, and electrical work are being taken by Mr. D. Fraser, O'Connor Street (owner and architect), in connection with the construction of two brick-veneer Residences on Nelson Street, at a cost of $7,000.

The erection of $7,000 residence on Hopewell Street, brick veneer construction, is contemplated by Mr. A. W. Davidson, 69 Grosvenor Street.

Contracts, other than heating and plumbing are to be let shortly in connection with $45,000 apartment building in course of construction on Third Avenue for Mr. Geo. Rupert, 38 Fifth Avenue, Ottawa. Messrs. Richards & Abra, Booth Building, are the architects.

Port Perry, Ont.
Tenders will be received by the architect, Mr. A. J. Carnegie, Water Street, for a $5,000 residence, brick construction, for the Carnegie Milling Company, Water Street.

St. Ours, Que.
Plans are in progress and the architect, Mr. Edgar Prairie, 202 St. Catherine E., Montreal, will invite tenders in two weeks for general contract to construct $6,000 residence, two-storey, concrete foundation, frame construction.

Toronto, Ont.
Plans have been drawn for $5,000 residence, 2½-storey, brick construction and foundation, on Gladstone Avenue for Mr. Thos. Thompson, 763 Shaw Street.

Westboro, Ont.
Plans are in progress for alterations to Summer Residence, the owner of which is Mr. Chas. Ogilvy, 293 Stewart Street, Ottawa. Mr. W. E. Noffke, 45 Rideau Street, Ottawa, is the architect.

CONTRACTS AWARDED

Hamilton, Ont.
The sub-contract for mason work on $8,000 residence on Main E., for Mr. Chas. A. Truman, Driving Park Hotel, has been awarded to Messrs. [illegible] & White, Hamilton.

Ottawa, Ont.
The general contract for constructon of $5,000 residence on Irving Street for Mrs. H. A. Anderson, brick veneer construction, stone foundation, has been awarded to Mr. A. Y. Smith, 320 Fairmont Avenue.

Power Plants Electricity and Telephones

Brockville, Ont.
Work on the construction of a telephone exchange for the Bell Telephone Company will probably be stopped shortly, but may be recommenced before end of year. Building will be three storeys, 45 x 35, limestone, terra cotta, fireproof

and brick construction. The architect is Mr. W. [illegible] Carmichael, Montreal, and the general contractors are Messrs. Pounder Brothers, 21 Downie Street, Stratford, Ont.

Kamloops, B.C.

Power house which has been erected at a cost of $500,000 for city council, will be ready for operation in about three weeks.

Lambeth, Ont.

A by-law for the installation of hydro-electric system will be submitted to the ratepayers on November 28. Mr. Geo. Riddell is clerk of the village council.

London, Ont.

The Canadian Westinghouse Company has been awarded the contract to supply London and St. Thomas with electrical equipment at $40,000.

Ottawa, Ont.

Tenders will be received by the chairman, Board of Commissioners, until November 24 for supply of two combination pumping engines, with hose bodies, capable of carrying 1,200 to 1,500 ft. of hose, capacity 1,000 gallons per min., engines 80 h.p. Prices are wanted with Standard wheels and Sewell wheels. Tenderers to state date of delivery. The chairman, Board of Commissioners, will also receive, until November 24, tenders for one 1,000-gal. steam fire engine, tractor-drawn, tractor to be four-wheeled, 80 h.p. Steamer to be rubber tired and fitted with Archibald wheels. Tenderers must state date of delivery. Can tender separately on engine or tractor.

Regina, Sask.

A quantity of additional machinery, to be installed in the new $90,000 power house for the city council, will be included in next year's estimates. The building is three-storeys, 218 x 75, and is located on Winnipeg and Douglas Street. Messrs. Storey & Van Egmond, McCallum-Hill Building, are the architects.

Shawinigan Falls, Que.

The Shawinigan Water & Power Company, Power Building, Montreal, have in contemplation the construction of a transmission line from Shawinigan Falls to Quebec City. Mr. Julian C. Smith, care of owner, is Engineer-in-Charge.

Teeswater, Ont.

The South Bruce Rural Telephone Company, Limited, have increased their capital from $10,000 to $50,000. Lines will be extended into Townships of Culross, Kinloss, Greenock, Bruce County, also Townships of Turnberry and Howick, Huron County. Mr. Keith McKenzie, is secretary.

Toronto, Ont.

Escher Wyss & Company, of Montreal, have been awarded the contract for two 2,250 h.p. water wheels with accessories by The Hydro-Electric Power Commission of Ontario for their new hydro-electric power plant at Eugenia Falls. These wheels work under a head of 540 feet running at 900 r.p.m.

The Ontario Railway and Municipal Board has ordered the Toronto Street Railway Company to build fifty new cars to be ready by June 1, 1915. Mr. R. J. Fleming is the manager.

Escher Wyss & Company have been awarded the contract for a 12,000 k.w., Turbo-Generator set for the Corporation of Leeds, England. This contract had previously been awarded to a German firm and was after the war awarded to Escher Wyss & Company, wth Siemens Generator 3-phase, 50 cycles, 6,750 volts. The speed of the set is 1,500 r.p.m.

Victoria, B.C.

The Vanderhoof Power Company, Limited, Permanent Loan Building, has filed plans for 10,000 acre-ft. reservoir. Water to be used for power purposes in vicinity of Vanderhoof, B.C. ... .

West Lorne, Ont.

The town council has in contemplation the construction of a hydro-electric line from West Lorne to Rodney. Reducing station will be erected at West Lorne. Equipment will also be purchased. Mr. W. H. Bole is town clerk.

Waterford, Ont.

The Hydro-electric Power Commission of Ontario will receive tenders for erection of sub-station here. The building will be brick construction. Mr. F. A. Gaby is chief engineer, and Mr. W. W. Pope, Continental Life Building, Toronto, is secretary.

Miscellaneous

Brantford, Ont.

Tenders will be called shortly for the construction of foundation for the Bell Memorial Monument, estimated to cost $3,000. The work will include excavating 200 cu. yds., 437 cu. yds. of concrete. Council will supply 9,300 lin. ft. of ¾-in. steel bars for reinforcing. Messrs. Barber & Tilley, Temple Building, are the engineers.

Ottawa, Ont.

No sub-contracts have yet been let in connection with $15,000 lavatories on O'Connor Street, for city council. Messrs. Murphy Bros., 49 Cooper Street, are the general contractors. The architect is Mr. Frank Sullivan, Castle Building, Queen Street.

Preston, Ont.

Sash making machinery will be required by Mr. Jas. Gillies, who contemplates manufacturing sash, window frame and screens.

Port Arthur, Ont.

The city has authorized the Canadian Northern Railway Company to construct stock yards at West Fort. Work will be started at once. Mr. Moody, C. N. R. Station, Victoria Avenue, is chief engineer.

Sydney, N.S.

The city council have received tenders for one freshwater turbine pump and one small air priming pump. The contract will be awarded about December 10. Mr. Norman Hay is the engineer.

Toronto, Ont.

Tenders will be received by the Board of Control, until December 8, for supply of 16-in., 22-in., 24-in., 30-in., 36-in. stop and check valves. Specifications are at office of Purchasing Department, City Hall.

Tenders close November 24 for annual supplies. Specifications, etc., are at Room 12, City Hall, Purchasing and Accounting Department. Materials include the following:—Rubber valves, hose, packing, etc.; iron and steel; lubricating oil; crushed stone; crushed trap rock; sewer pipe, vitrified; sewer brick; paving pitch or filler; gravel, screened and unscreened; granite setts; Portland cement; paving blocks, vitrified; mineral dust or filler; rubble stone; house numbers; aphatl, refined; general hardware.

Late News Items

Hillsburg, Man.

The ratepayers of this town will vote on December 15 on by-laws for construction of roads and bridges at an estimated cost of $20,000. Mr. H. Jaasuud, Roblin, Man., is the town clerk.

Medicine Hat, Alta.

The city council has started street paving work, estimated to cost $50,000, in this city. The work is being done by day labor under the supervision of Mr. A. K. Grimmer, city engineer.

Owen Sound, Ont.

The sub-contract for plastering the $14,000 bank in course of erection on Second Avenue and Ninth Street for the Merchants Bank, will be sub-let by the general contractors, Messrs. Green & Wollrich. The building will be three storeys, stone and brick construction.

Province of Ontario

A Peace Memorial highway, extending across the Province from Windsor to Montreal, is said to be in contemplation. The mileage, outside of urban districts, except sections of road such as the Toronto-Hamilton highway, is estimated at 375 miles. The estimated cost is about $6,000,000. It was suggested that the cost might be contributed to by municipalities with the co-operation of the organized motorists of the province.

Toronto, Ont.

The board of control has let the following contracts for sewer pipe in connection with the North Toronto sewerage system:—National Iron Works, Toronto, 24-in. pipe, $5,/80 per length; 36-in pipe, $9,445 per length; Canadian Allis-Chalmers, Limited, Toronto, 30-in. pipe, $7,280 per length; 30-in. B pipe, $9,595 per length.

Victoria, B.C.

The Pacific Great Eastern Railway Company, 711 Belmont House, have filed plans for a bridge to be erected over Lillooch River, at Station 1041.

Vancouver, B.C.

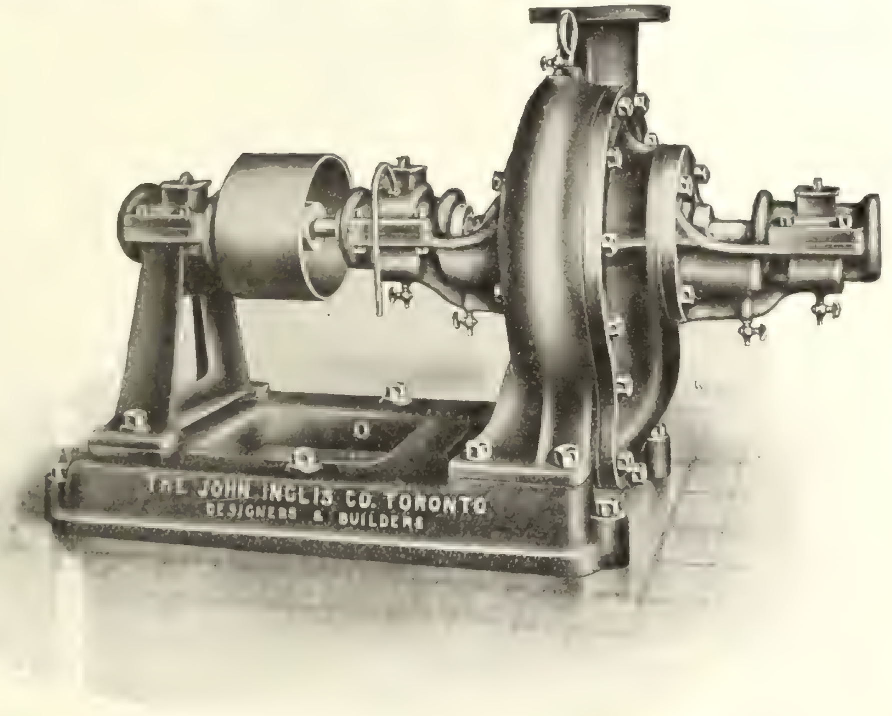
The Peace River and Athabasca Railway Company will apply at next session of Dominion Parliament for legislation authorizing them to construct 169 miles of road from Kitimat Arm to Mouth of Bear River. Messrs. Pringle, Thompson, Burgess & Cote, Union Bank Building, Ottawa, are the company's solicitors.

F. H. Hopkins & Company, railway and contractors supplies, Montreal, have dissolved. Mr. Jas. J. Rosevear has retired. Frank H. Hopkins and Robert A. C. McNally will continue the business under the same style.

IRON Fences, Wire Fences, Gates, Fire Escapes, Jail Cells, Office Wirework. Wire Baskets and all kinds of Builders' Wire and Ironwork.

THE PAGE WIRE FENCE CO.
LIMITED
Walkerville, Toronto, Montreal, St. John

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Tenders and For Sale Department

Tenders for Stop and Check Valves

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 8th, 1914**, for the supply of 16-in., 22-in., 24-in., 30-in., 36-in. Stop and Check Valves.

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by city by-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer or in lieu thereof, the bond of a Guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, November 12th, 1914. 46

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, November 20th, 1914

for all trades

Enlargement of Regal Road School

Temperature Regulators, Sundry Schools

Electric Wiring, Sundry Schools

Metal and Glass Partitions, Sundry Schools

Terrazzo Floors, Sundry Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer, at his office, in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

J. W. JACKSON,
Chairman of Committee.

W. C. WILKINSON,
46 Secretary-Treasurer.

CITY OF ST. CATHARINES

Tenders for Superstructure of Steel Viaduct

Sealed Tenders for the construction of the superstructure of the St. Paul St. High Level Bridge, addressed to the City Clerk, will be received until five o'clock p.m. on the **8th day of December, 1914**.

Principal Items of Work

Structural Steel	2,600,000 lbs.
Fence and Hand-railing	2,420 lin. ft.
Car rails and fittings	105,250 lbs.

Information for tenderers, plans and specifications and form of tender may be obtained at the office of the City Engineer, St. Catharines, Ont., on receipt of a deposit of Ten Dollars which will be refunded on receipt of a bona fide tender.

A certified cheque in the amount of $5,000.00, payable to the City Treasurer, is required to be deposited with the bid, and a construction Bond of $25,000.00 shall be furnished the City by the Tenderer to whom the contract is awarded.

The City reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the City.

J. ALBERT PAY,
City Clerk.
W. P. NEAR,
46 City Engineer.

Tenders for Annual Supplies

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, November 24, 1914**, for the supply of:

1. Rubber Valves, Hose, Packing, etc.
2. Iron and Steel.
3. Lubricating Oil.
4. Crushed Stone.
5. Crushed Trap Rock.
6. Sewer Pipe, Vitrified.
7. Sewer Brick.
8. Paving Pitch or Filler.
9. Gravel, Screened and Unscreened.
10. Granite Setts.
11. Portland Cement.
12. Paving Blocks, Vitrified.
13. Mineral Dust or Filler.
14. Rubble Stone.
15. House Numbers.
16. Asphalt, refined.
17. General Hardware.

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section of the Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering, as prescribed by city by-law, must be strictly complied with, or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
Toronto, November 15, 1914. 46

To Contractors

Sealed tenders address to either of the undersigned will be received until noon on **Tuesday the 8th day of December** for building a steel riveted truss bridge over the River Thames between the Counties of Elgin and Middlesex (known as the Tait Bridge) length of span C to C, 220 feet and also for the steel beams and railing required for 255 feet of approach. Also for the concrete work consisting of abutments, piers and pedestals.

A certified cheque payable to the Treasurer of one of the Counties for 5 per cent. of the amount of tender must accompany tender. Plans and specifications may be seen at the office of the undersigned. Lowest or any tender not necessarily accepted.

JAS. A. BELL, C.E.,
Engineer for Elgin, St. Thomas.
CHAS. TALBOT, C.E.,
46-48 Engineer for Middlesex, London.

Township of North Easthope

Tenders Wanted

Sealed tenders marked "Tenders for Krampien Drain" will be received by the undersigned up to 2 o'clock p.m. on Wednesday, **November 25th, 1914**.

The Council will proceed to consider the Tenders immediately after the above hour at the Clerk's office, Amulree. Plans, profiles and specifications can be seen at the Clerk's office, or at the office of Jno. Roger, O.L.S., Mitchell.

The drain commences on lot 10, con. 8, and has its outlet in the Township of Wilmot.

A deposit of $200 is required, cash or marked cheque.

The lowest or any tender not necessarily accepted.

(Signed) J. D. FISHER,
Township Clerk,
R. R. No. 1, Stratford, Ont.
Dated the 11th day of November, 1914. 46

Lines Wanted

Firm opening Contractors' and Builders' Supply Yard in a large Western Ontario city would like to secure a few more good lines. Forward full descriptive matter to Box 105, Contract Record, Toronto. 46-47

Agents Wanted

We are open to appoint Provincial agents for our frost proof water meters. Adopted by leading towns and cities in Northern States. Apply Box 103, Contract Record & Engineering Review, Toronto. 45-47

Agents Wanted

Canadian firms having good municipal connections can make money selling a new improved sewer cleaning machine which already has a big sale in the U. S. A. Write stating the territory you can cover. Box 97, Contract Record & Engineering Review, Toronto. 44-46

Representatives Wanted

U. S. Paint and Varnish Manufacturers want representatives who are well acquainted with leading Architects and Contractors, in each Canadian province. Exclusive Provincial agencies will be given to right parties. Box 104, Contract Record, Toronto. 45-47

Nothing Saved

Stopping an ad.
to save money is
like stopping a
clock to save time

Contract Record
and Engineering Review

Toronto Montreal Winnipeg
Vancouver London, Eng.

STANDARD Wires and Cables

- Wire Rods
- Bare Copper Wire
- Brass and Bronze Wires
- Standard C. C. C. Wire (Colonial Copper Clad)
- Magnet Wire
- Weatherproof Wire
- Rubber Insulated Wire
- Varnished Cloth Cable (Varnished Cambric)
- Fibre Lead-Covered Cable
- Paper Lead-Covered Cable
- Rubber Lead-Covered Cable
- Armored Cable

and Cable Accessories

- Cable Terminals
- Cable Junction Boxes
- "Ozite" Insulating Compounds
- Miscellaneous Cable Accessories of all kinds
- Cable Installations

For detailed information, samples, estimates or prices write our nearest office.

STANDARD UNDERGROUND CABLE CO.
OF CANADA, LIMITED
Hamilton, Ont.
Montreal, Que. Winnipeg, Man.
Seattle, Wash.

Many People Do Not Realize The Vast Proportions of Our Business

They know that the name

Sturtevant
(REG. CAN. PAT. OFF.)

is synonymous with "fans"

and that Sturtevants are the largest manufacturers in the world of Fans, Heating and Ventilating Apparatus but they do not know of our other products.

Our other products are not experiments but are in universal use all over the globe.

We make Engines, Generating Sets, Turbines, Economizers, Drying Apparatus, Mechanical Draft Apparatus, Motors, Steam Traps, Air Washers and other less important lines.

These products are described in 70 catalogues and bulletins. We have a concentrated description of them in our General Catalog just published.

The B. F. Sturtevant Company
of Canada, Limited
GALT, ONT.

Sales Office for Eastern Canada
919 New Birks Building, Montreal, P.Q.

PAGE
CONCRETE
REINFORCEMENT
IN FLAT SHEETS

Can be supplied in rolls
if preferred.

For Concrete Road Pavement, Walks, Building Floors, Etc.

We are the originators of this wire reinforcement in flat sheets, and it is coming into universal use wherever introduced. We have supplied many carloads of it this past season.

The standard mesh for road pavement is 6 x 12 inches; for bridges and building floors, the standard is 3 x 6 inches. Also other meshes as desired. All sheets 4 feet wide, and any length specified that can be loaded in cars.

Samples will be sent upon request.

We also supply Iron Fences, Fire Escapes, Office Wire Work and all kinds of Builders' Wire and Iron Work.

The Page Wire Fence Co., Limited
DEPT. 1a
1157 King St. W., TORONTO
87 Church St., WALKERVILLE
505 Notre Dame St. W., MONTREAL
39 Dock St., ST. JOHN, N. B.

FOR SALE

1—Class B 1 Rand Duplex steam driven Air Compressor, duplex steam and air cylinders 8 x 12, Automatic oil feed and self regulating governor, heavy fly wheel.
1—8 x 12 C. C. Engine with Pickering governor.
1—6½ x 8 S. C. Engine with Pickering governor.
2—Plunger or Jack Pumps pistons 2 7/16 and 2 7/8.
1—30-in. Boston Cupola and forge blower.
1—Single Drum 8 x 11 double purchase Mast Winch.
1—Set Car Irons, 24-in. chilled wheels, 3½-in. axles, 36-in. gauge. Babbitted bearings outside wheels.
2—Vertical Boilers (new), 30-in. x 72-in., mountings and short stack.
1—Rand Air Hoist Class "B" 4-in. x 4-ft. lift.
1—Steel Ore Bucket, straight sides, 37 x 37, ring and pin fastening (new).
1—Steel Ore Bucket, taper sides, 8 cu. ft., ring and pin fastening (new).
1—6-ply Monarch Rubber Belt, 20-in. x 60-ft.
1—7 x 12 D.C. S.D. High Speed Hoist (Drum 36 x 36).
Several Stratton steam separators for pipes, 1-in. to 5-in. (new).

All in good working order and open to inspection at our plant.

Marsh & Henthorn, Limited
BELLEVILLE, ONT.
Makers, Hoisting Machinery

FOR walls and ceilings of Public Buildings — Hotels, Theatres, Town Halls, Schools and Churches—leading Architects are specifying

LINABESTOS

"The only Wall Board that is fire-proof."

Linabestos is made of Portland Cement and Asbestos, in sheets 3/16 inches thick, 42 inches wide and 4 or 8 feet long. It is nailed direct to studding or ceiling joists, and the joints are either paneled or filled with cement. It can be left in its attractive natural tone of pinkish grey or tinted or painted any color.

Rotunda of Larocque Hotel, Valleyfield, lined with Linabestos.

Walls and Ceilings of Linabestos are sanitary, fireproof and will never crack or fall. They are just as satisfactory in private houses, offices, and first class garages or coach houses as in big public buildings.

Write for a sample of Linabestos, and descriptive folder 9 to

ASBESTOS MANUFACTURING CO., LIMITED
Address—E. T. Bank Bldg., 263 St. James St., MONTREAL.
Factory—at LACHINE, P.Q., (near Montreal)

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a quarter of a million."**

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886
Contract Record
and Engineering Review

347 Adelaide Street West, Toronto

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5 barrel lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, with bags $1.95.

Lime—grey 38c, white 40c. per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.60; King Edward Siding; $6.50 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$3.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 57c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 67c, per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 57c per gal. of 9 lbs. Raw linseed oil—in barrels, 54c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del. South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

(Continued on page 7)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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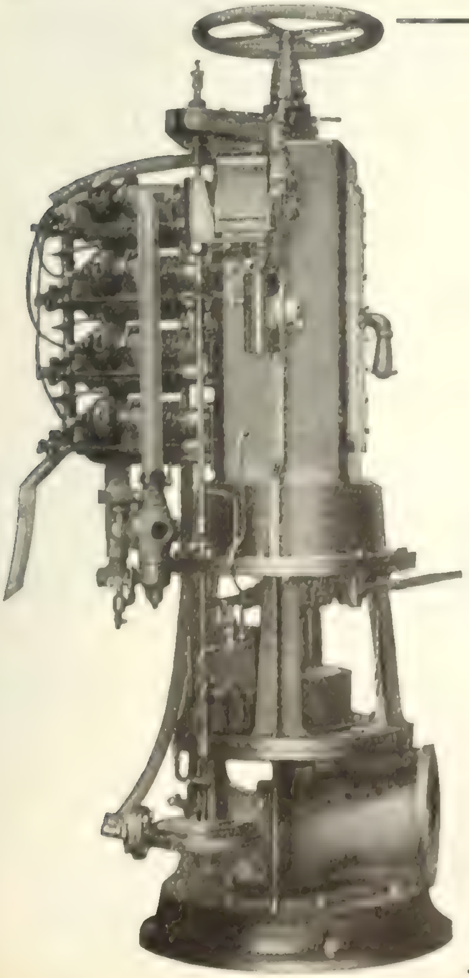

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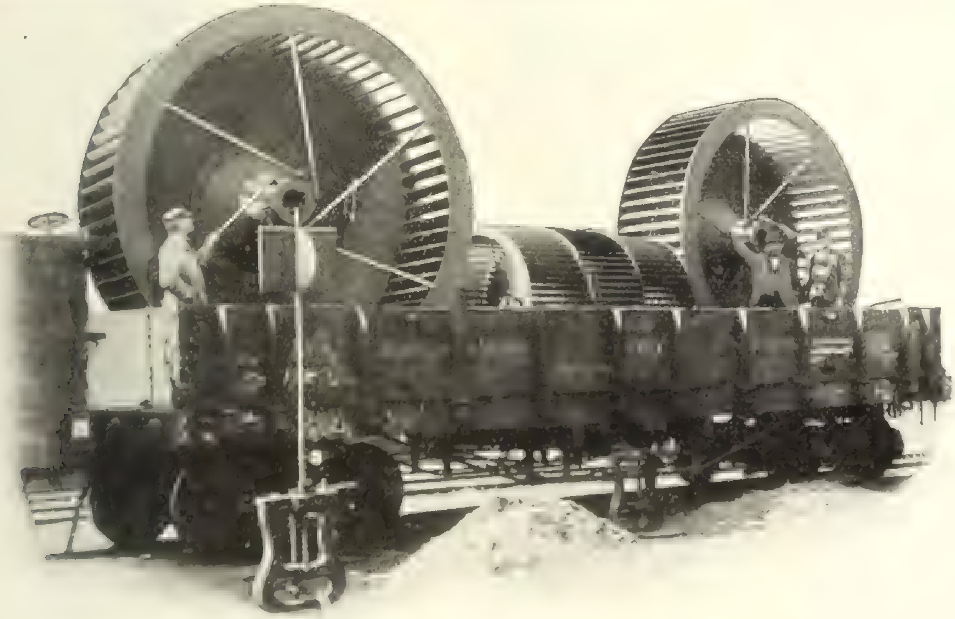

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Branches: Vancouver and Winnipeg
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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68.)

LUMBER (BUILDING MATERIAL)

(15 per cent discount for cash)

Flooring—No. 2 red pine, 4 in., $45; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, ship-lap grain, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $45.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 74 cents per gal.; raw linseed oil, in bbls., 71 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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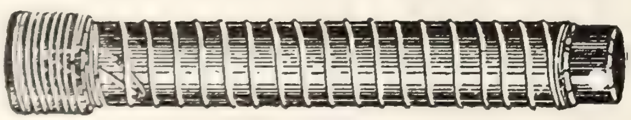

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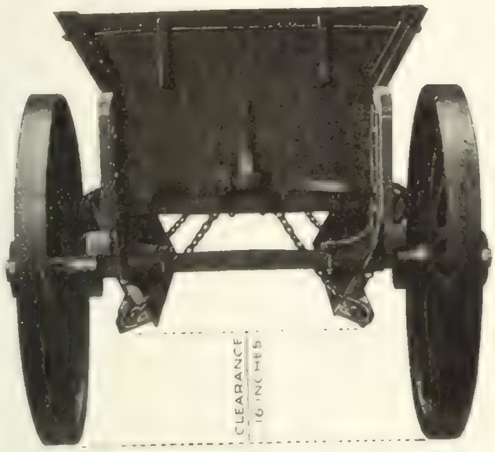

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Slack taken up on winding drum.
Just like a Hoisting Engine.

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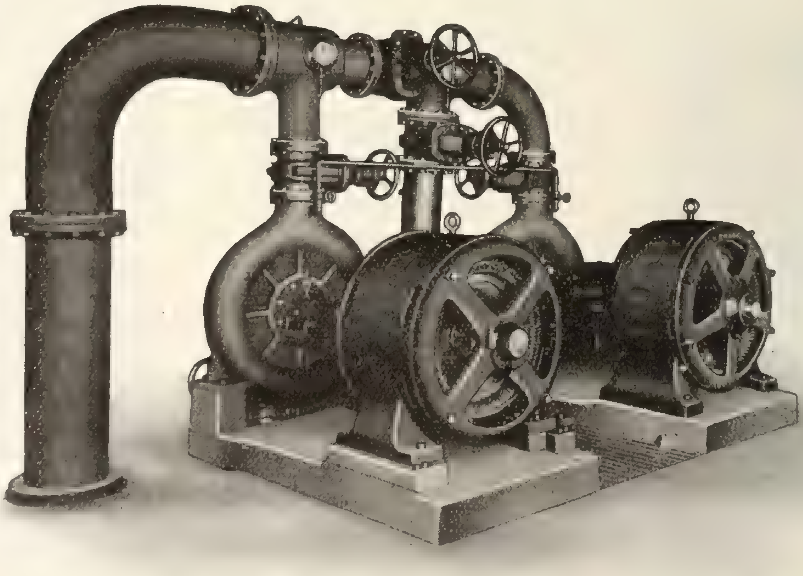

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has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16" to 3/4" inclusive.

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Welded or Rivetted

WITH ANY TYPE OF JOINT
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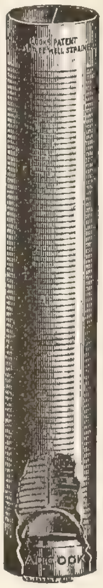

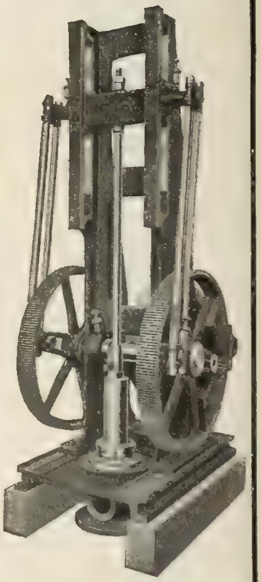

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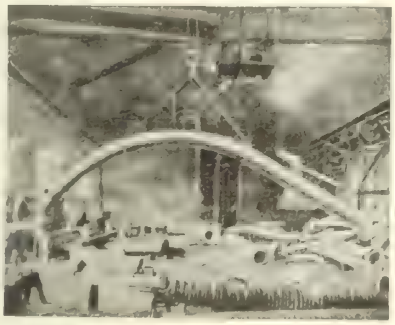

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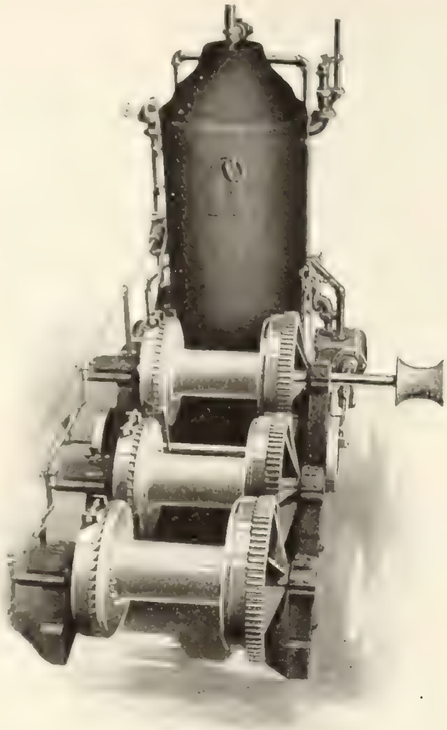

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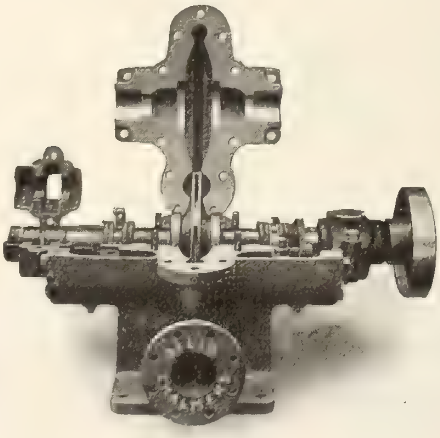

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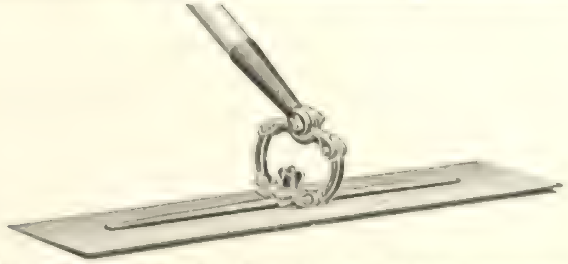

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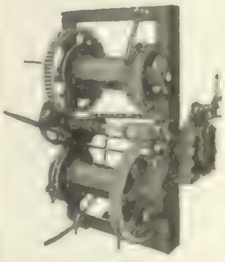

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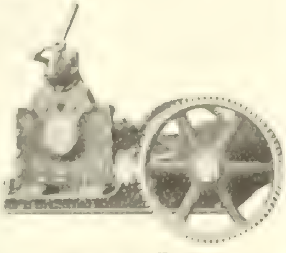

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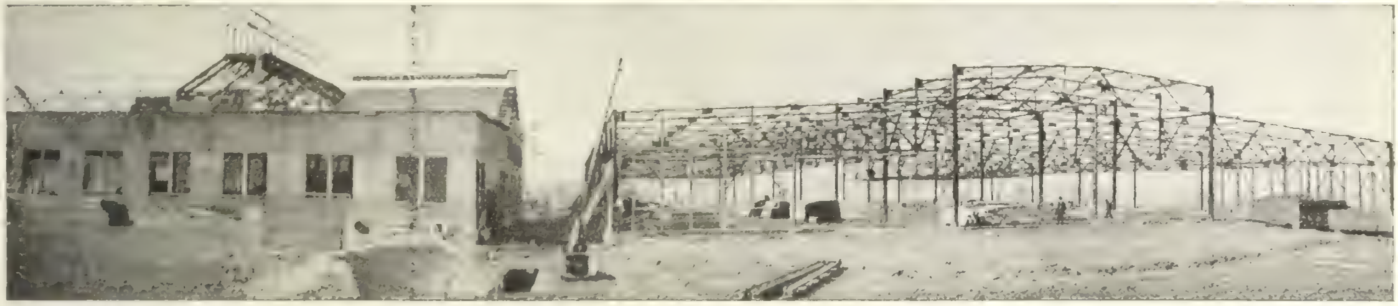

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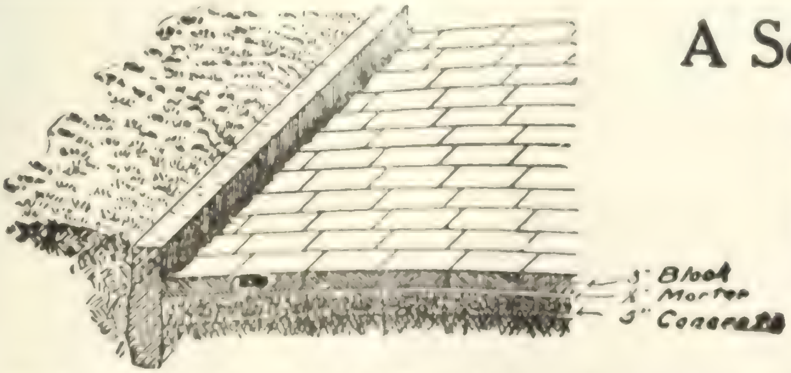

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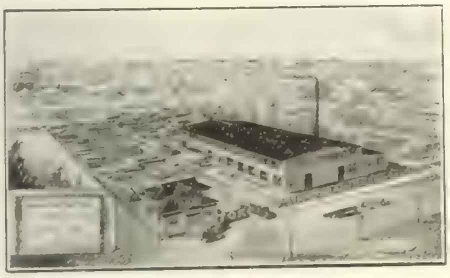

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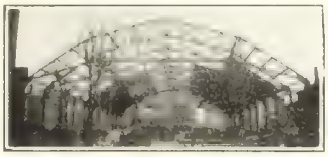

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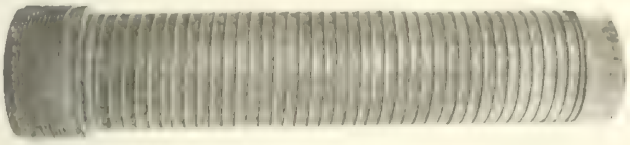

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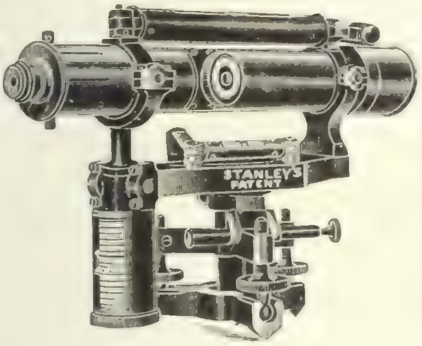

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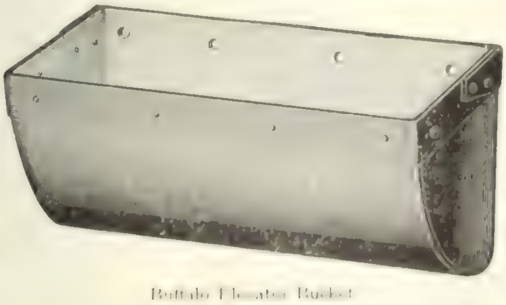
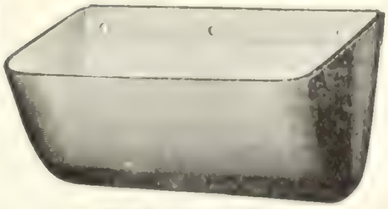
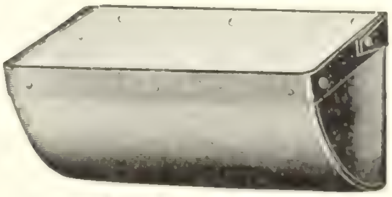


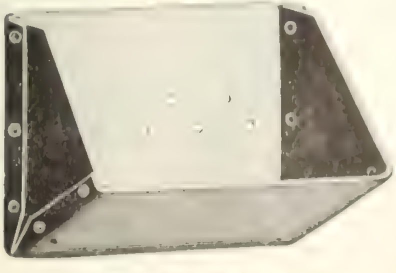
Buffalo Elevator Bucket



Salem Elevator Bucket



Empire Elevator Bucket



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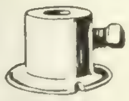

Fig. 1

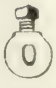

Fig. 2

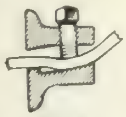

Fig. 3

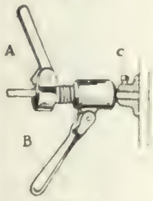

Fig. 4

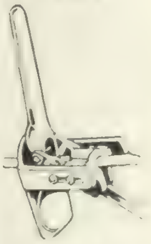

Fig. 5

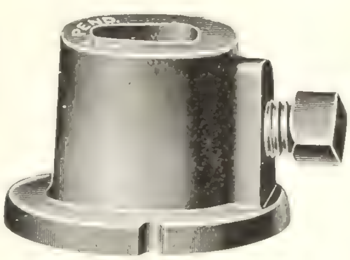

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Fig. 2, shows the cross-section of the clamp, with the oval hole.

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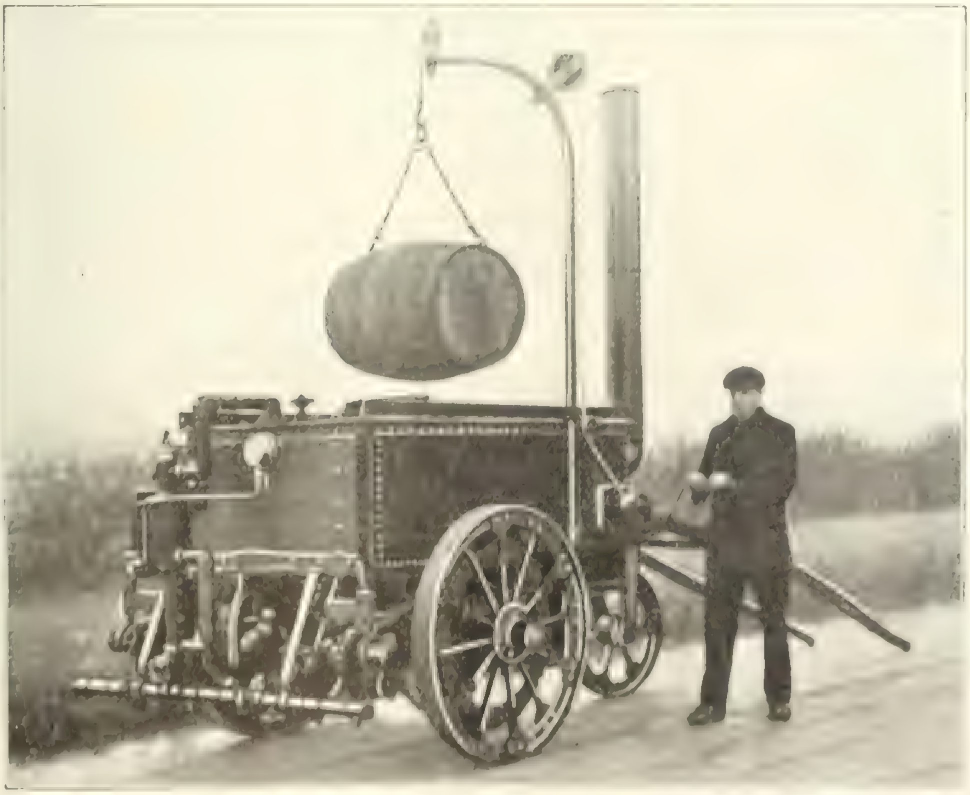

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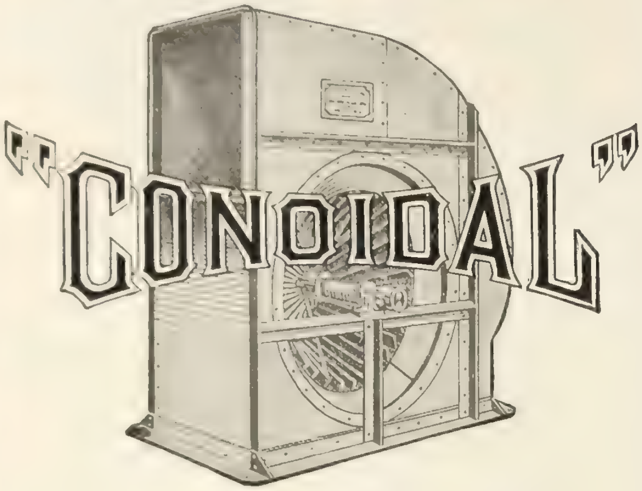

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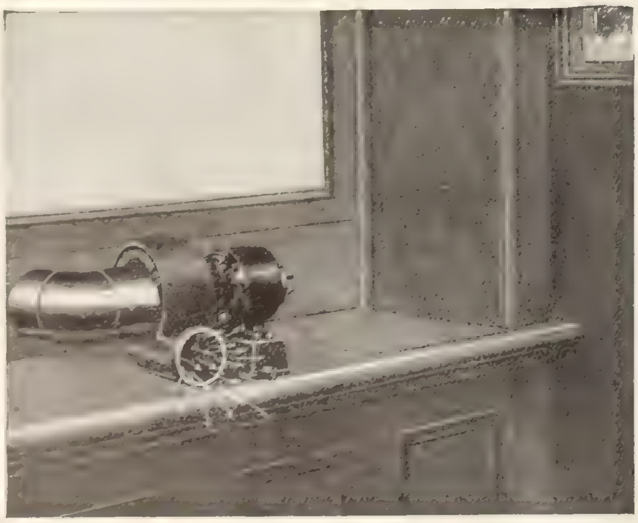

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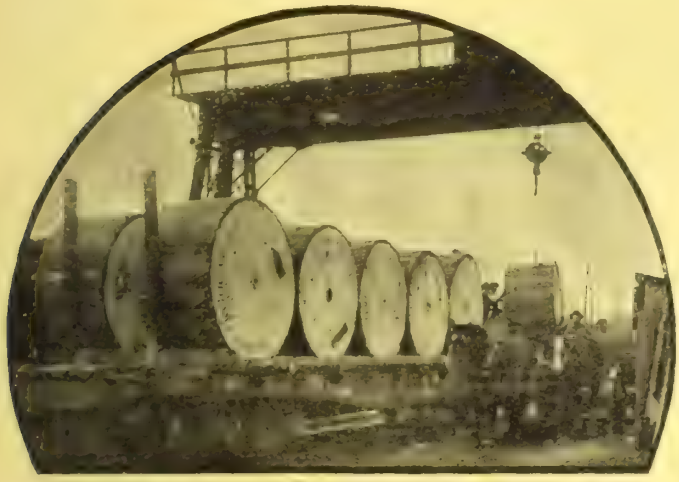

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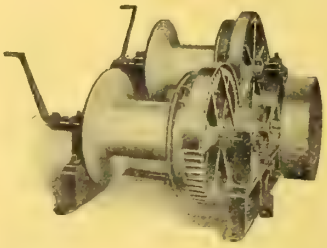

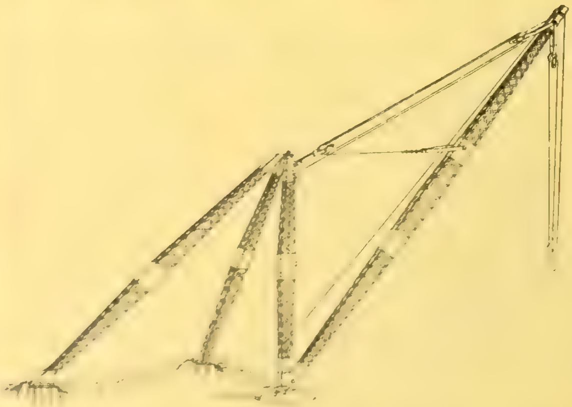

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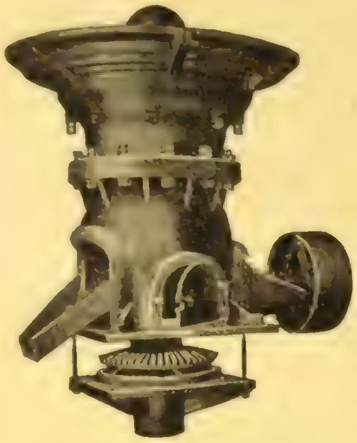

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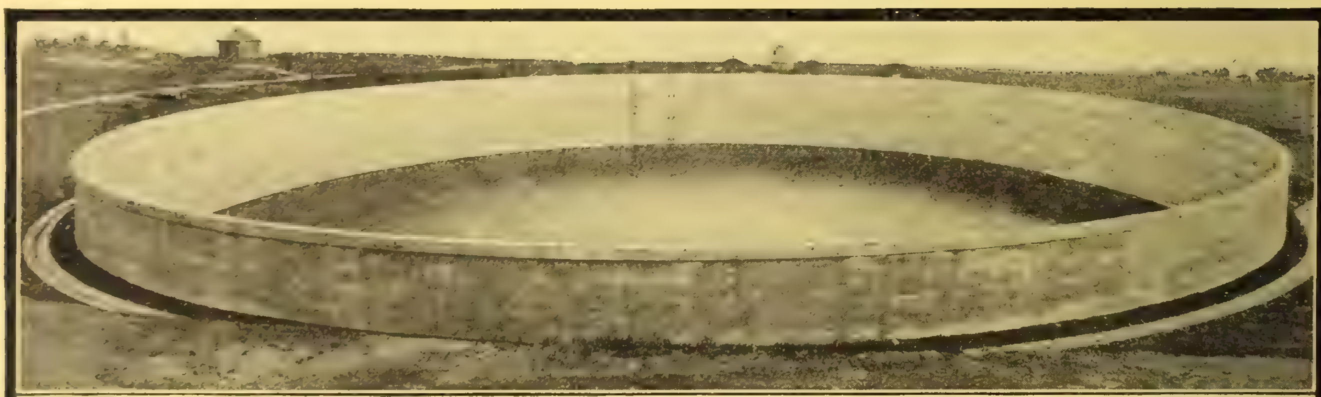

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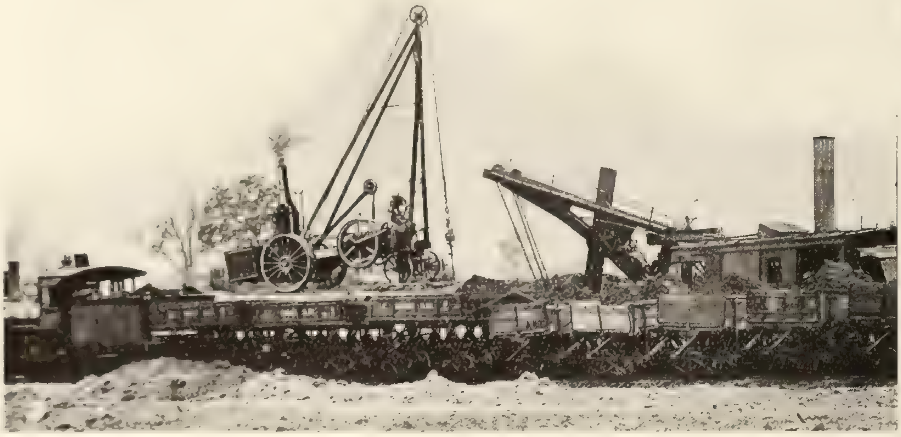

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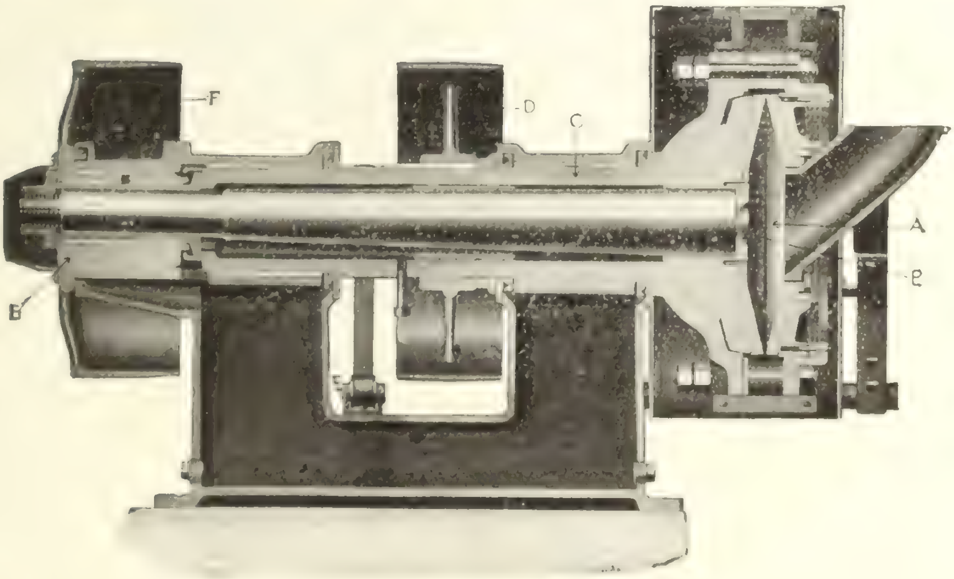

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Woodhouse Chain Works

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Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Placing foundation for G.T.R. elevator (annex) at Windmill Point, Montreal—1616 Simplex Standard piles used.

Showing Simplex Standard pile driven at G.T.R. elevator (annex) Windmill Point, Montreal.

Showing machines at work on the G.T.R. elevator (annex) Windmill Point, Montreal.

Simplex

A Sure Foundation

A foundation on Simplex concrete piles is sure to be non-settling and everlasting.

A simplex concrete pile is equal to natural rock because it forms a perfect monolith. Its cylindrical shape gives the column of concrete the maximum strength throughout its entire length and the maximum bearing surface; permits it to be driven any depth and the withdrawal of the driving tube permits the plastic concrete to be cemented into the compressed earth itself. Piling made on this principle cannot fail to give a sure foundation.

Simplex concrete piling is suitable for dock, wharves and other water work, or for foundations through wet peat, or where very soft, boggy conditions prevail.

Send for our concrete piling book.

Simplex Concrete Piling Company, of Philadelphia

Canadian Representatives

Simplex Construction
Company, Limited
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THE NORTHWESTERN TERRA COTTA COMPANY

C. P. R. OFFICE BUILDING
Darling & Pearson, Architects

DOMINION BANK BUILDING
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Two prominent corners in Toronto
The Terra Cotta for both buildings was
manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

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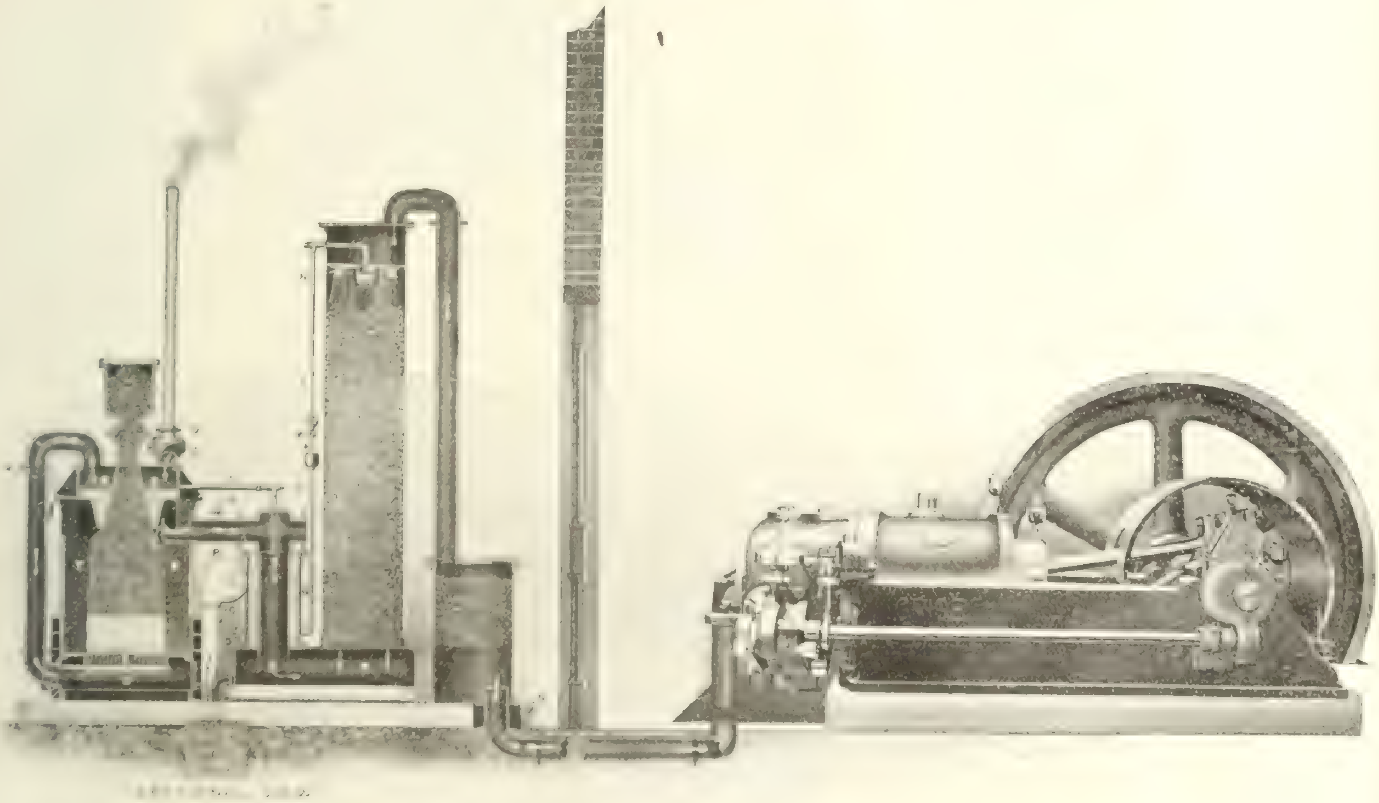
Agencies in all the large cities of Canada.

GAS ENGINES

For Operating on Suction, Town or Natural Gas



Engines made in all sizes up to 300 B. H. P.

Suction Gas Plants for operating on
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Thousands of these engines and gas producers, working successfully all over the world.

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Hy-tex Brick

THE word "Hy-tex" is a mark of identification for brick of every kind, in the most beautiful and varied color-effects and the most pleasing and distinctive of rough or smooth textures, known to brickcraft.

It is the name given the entire product of the Hydraulic-Press Brick Company, the largest manufacturers of face brick in the World; who have factories in 19 states and own clay beds in the principal deposits of the nation.

The name Hy-tex was given the entire Hydraulic product so that the architect—no matter what brick he wished to use—could ***specify*** and ***know that he received*** "The Standard of Quality" in ***any*** color-range or ***any*** texture.

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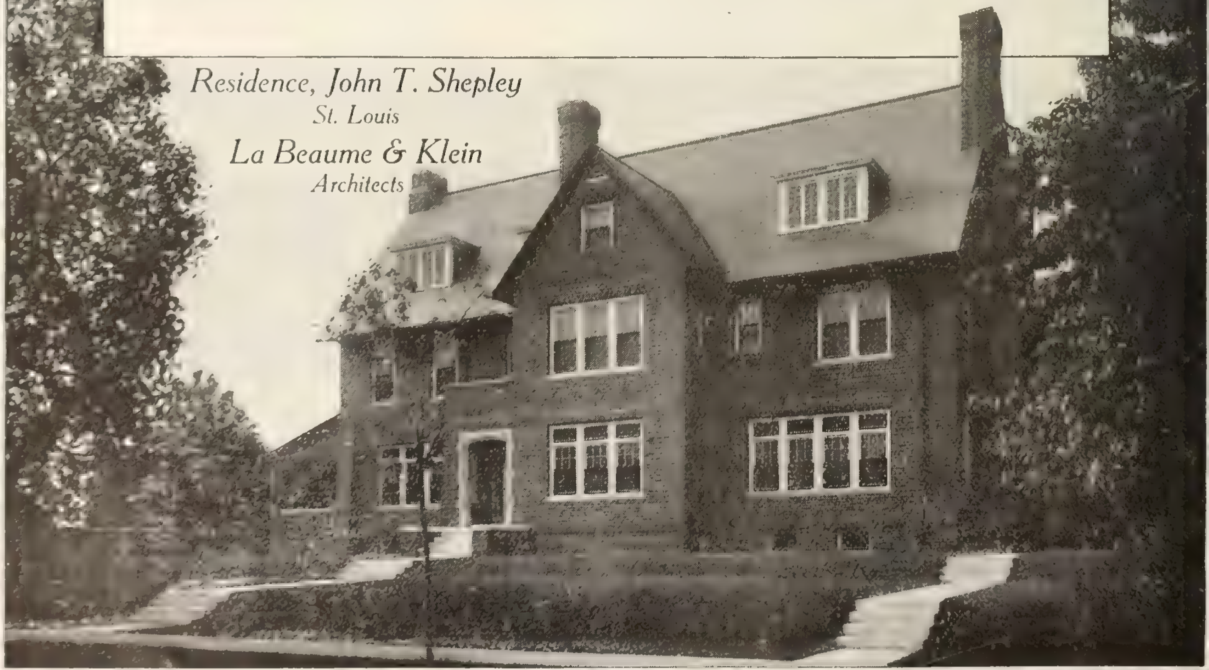

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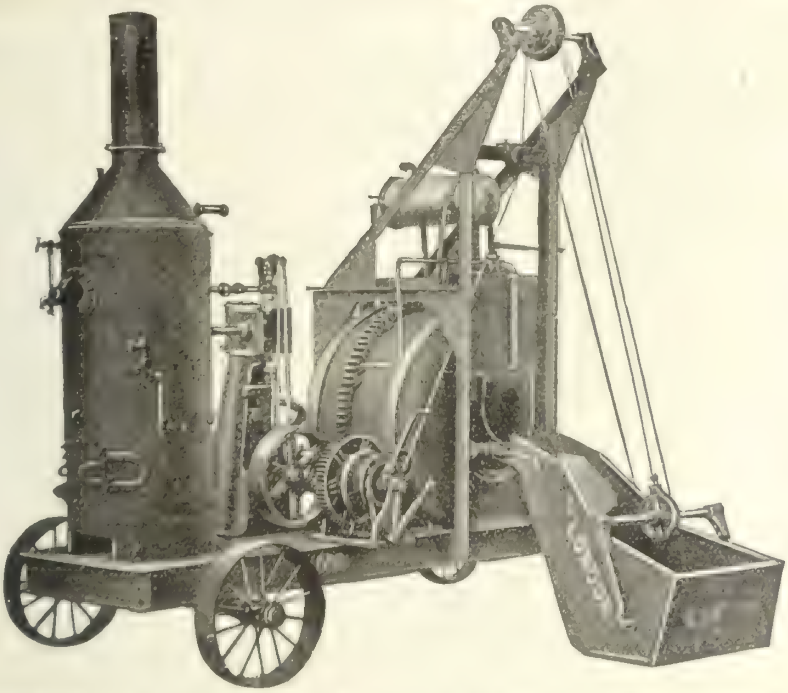
Architects



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(Continued on Page 14)

Made In Canada

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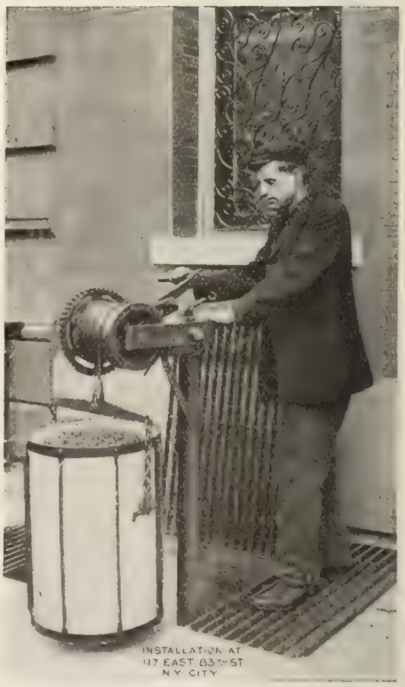

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(Patented)
Telescopic Hoist

With compound gear and brake attachment.
When not in use no part shows above sidewalk.
Strongly constructed of best materials. Very simple to operate and takes up no room in cellar.

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Warren

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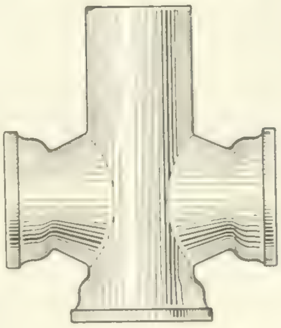

Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

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Prompt shipments.

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and Machine Co.
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Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

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must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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(Continued on page 16)

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Sheet Metal Building Materials

Are Rust-Resisting

And Will Give Unequalled Service and Satisfaction

Especially adapted for all exposed sheet metal work

OUR LINE CONSISTS OF THE FOLLOWING PRODUCTS:

Corrugated Iron
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Our manufacturing facilities are the most up-to-date for the lines we make in Canada. Our large stocks assure quickest delivery possible. Let us quote you prices on your immediate and future requirements and send full information on **Why Sarnia Sheet Metal Products are Better.**

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All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

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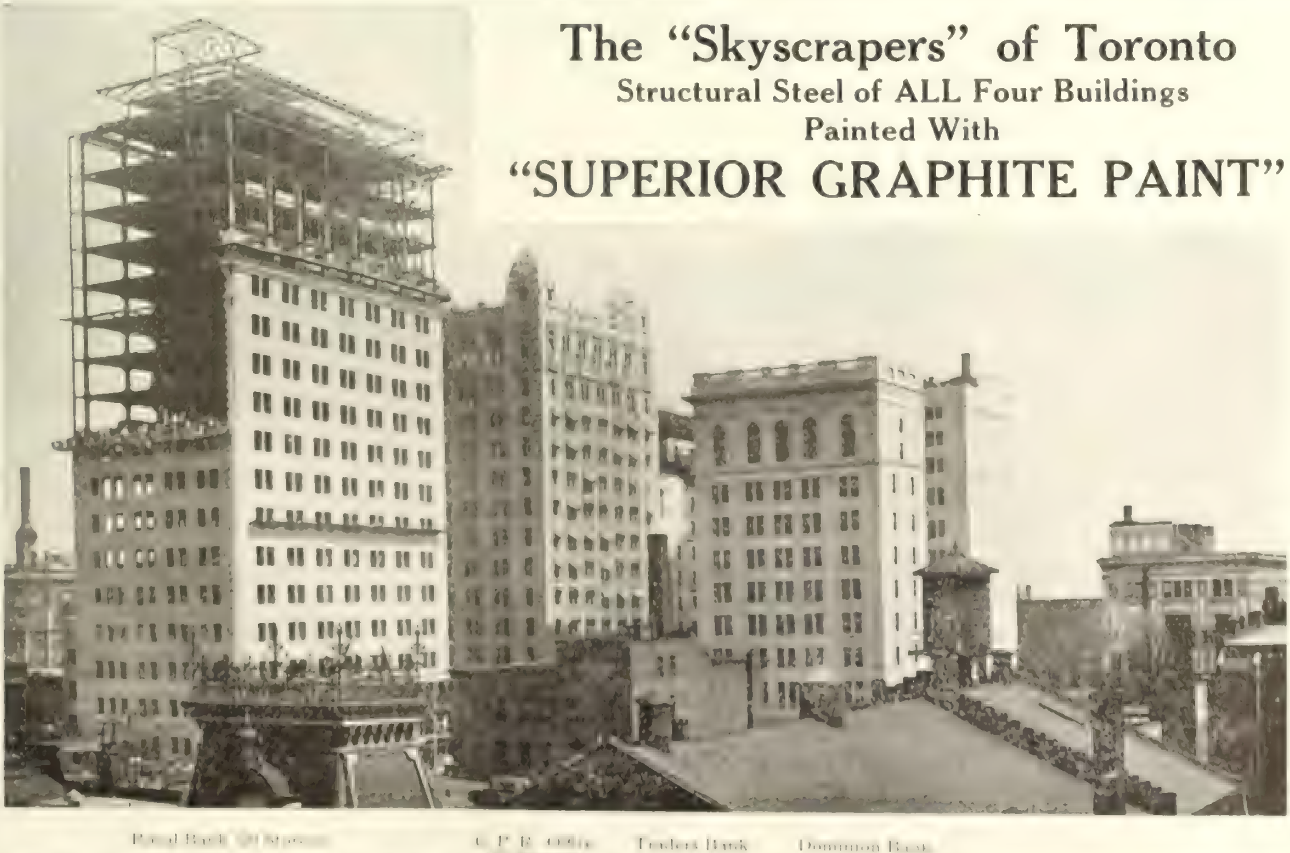

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- Jenckes Machine Company
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Preserves Roads
Prevents Dust~

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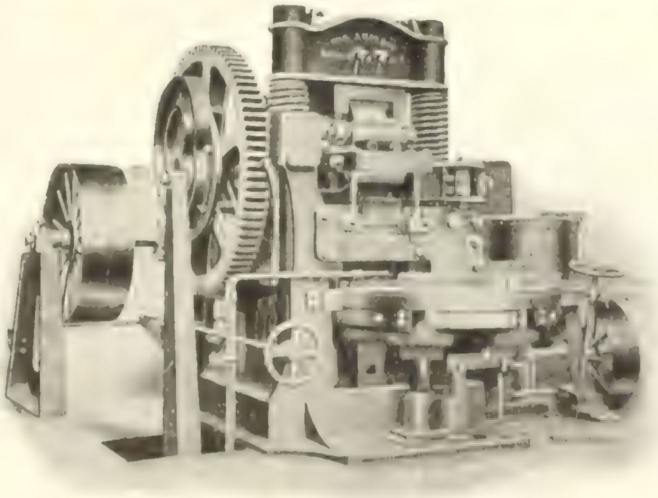

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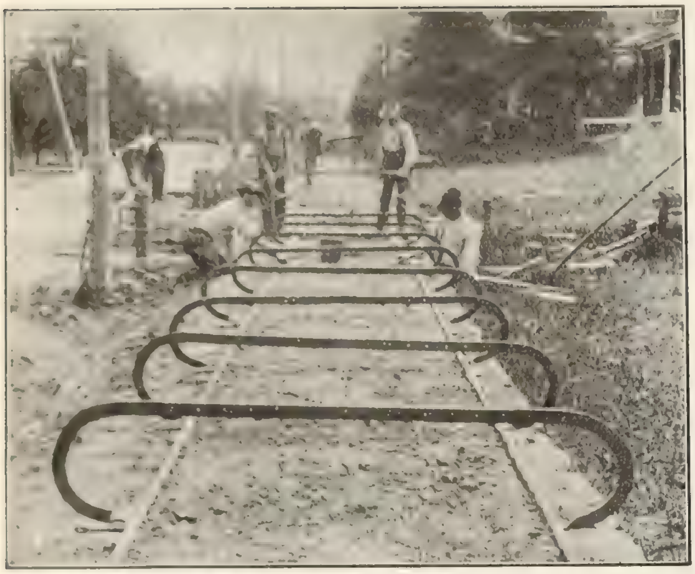

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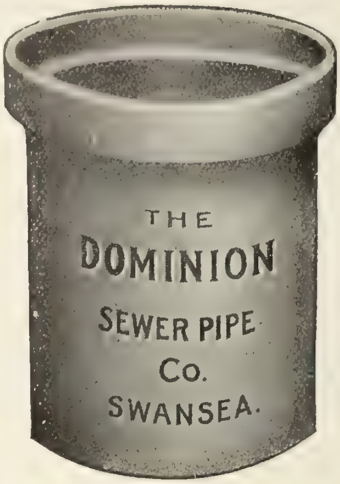

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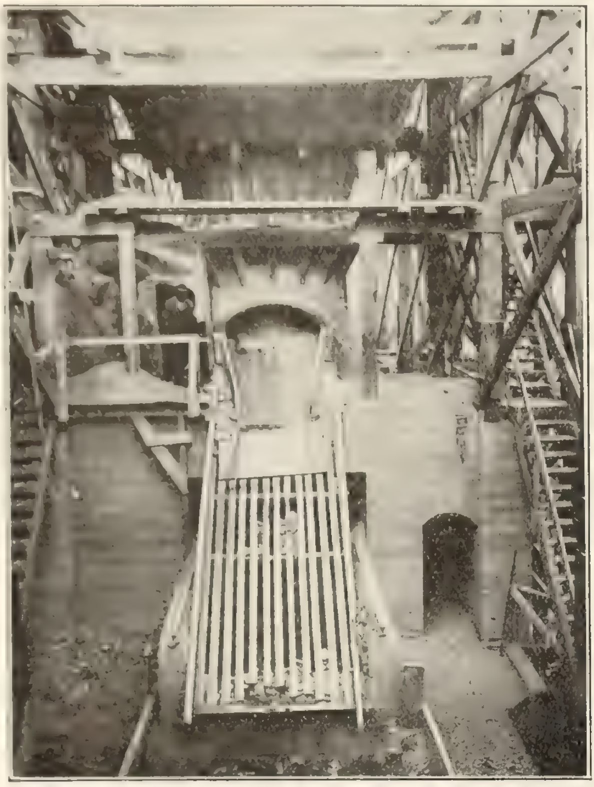

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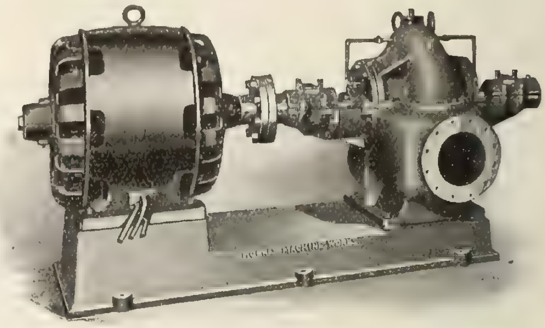

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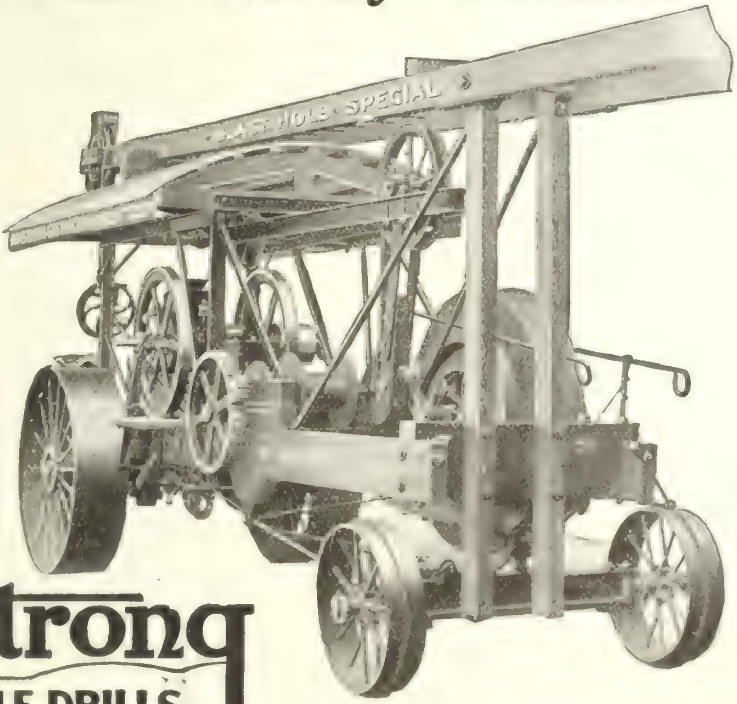

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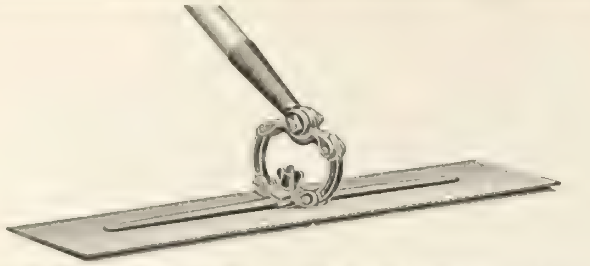

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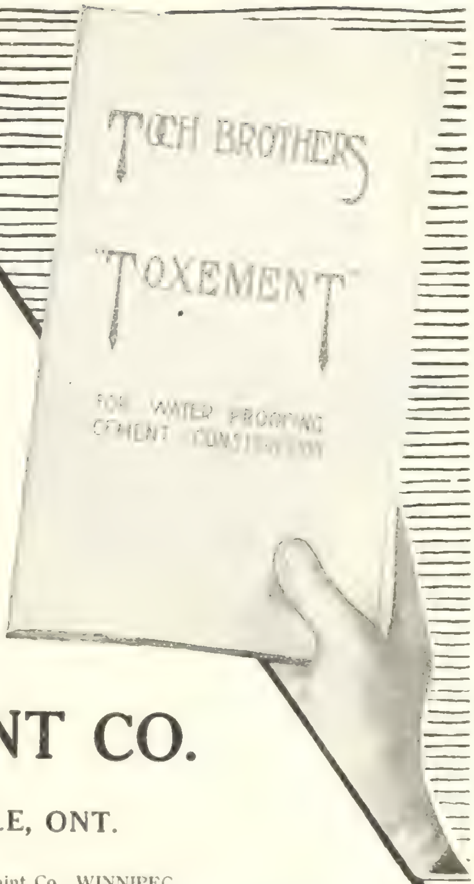

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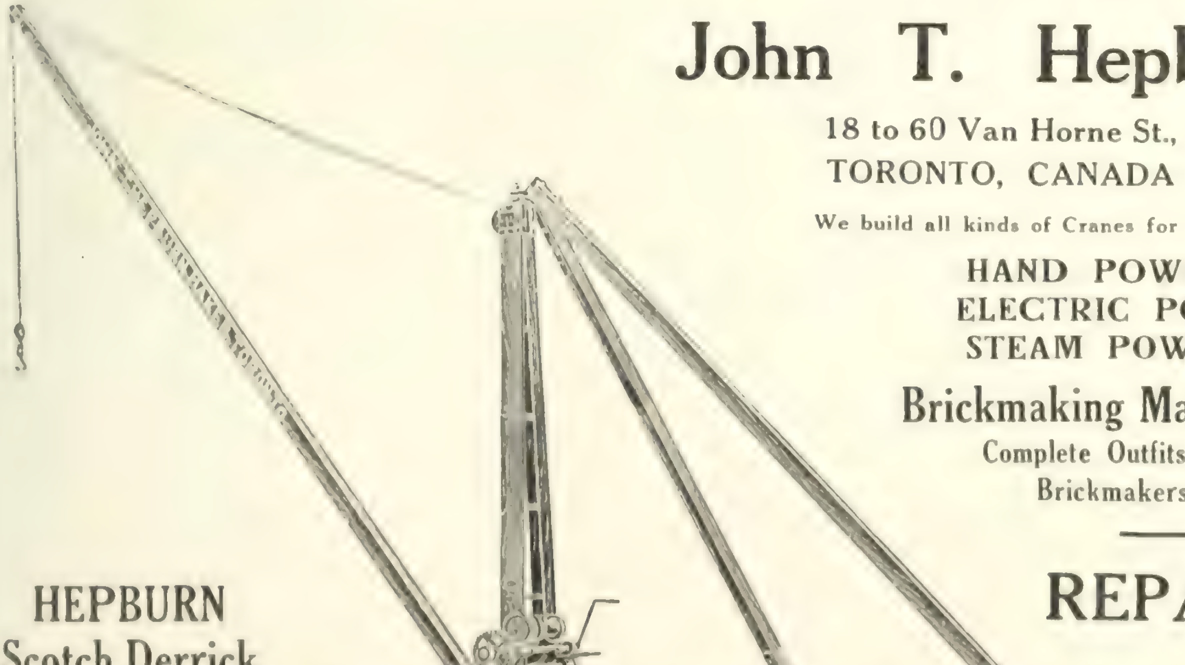

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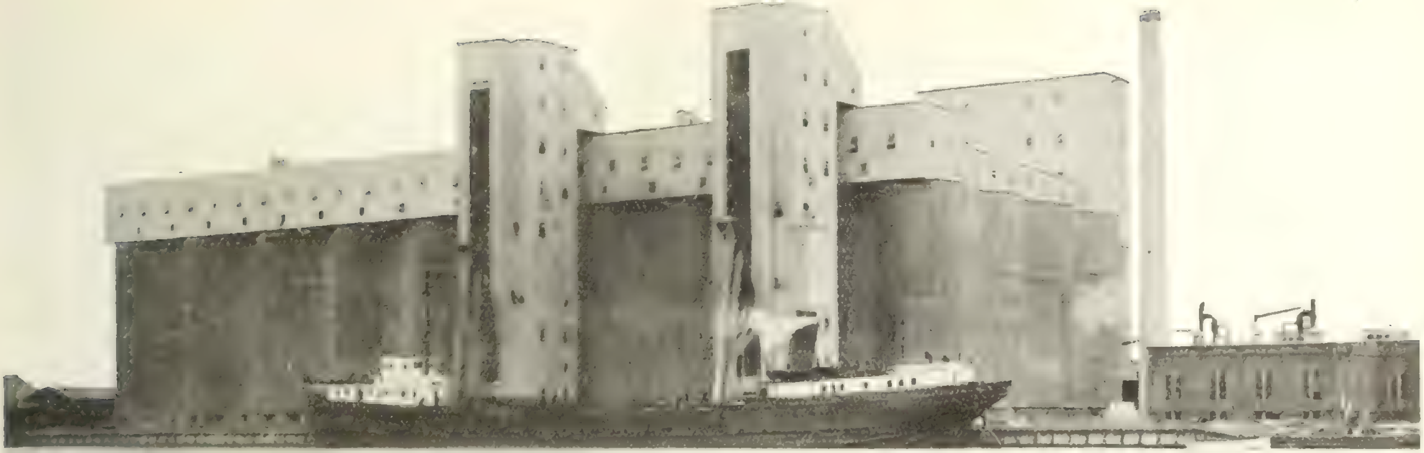

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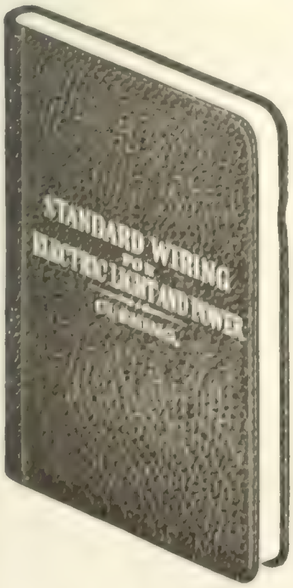

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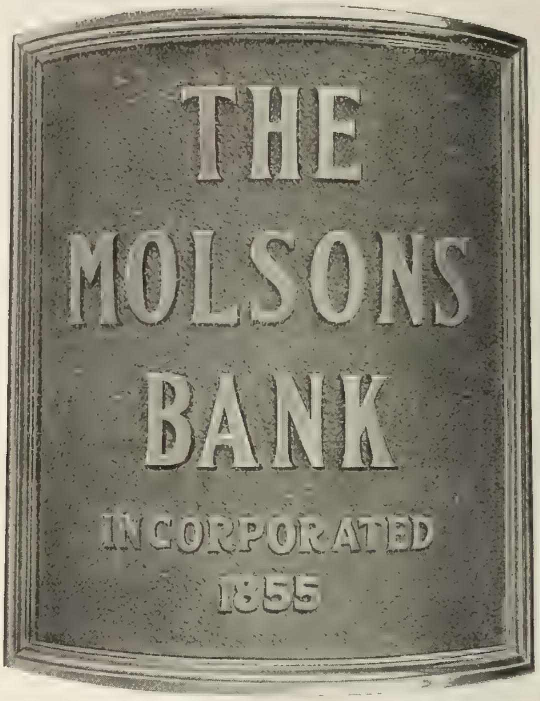

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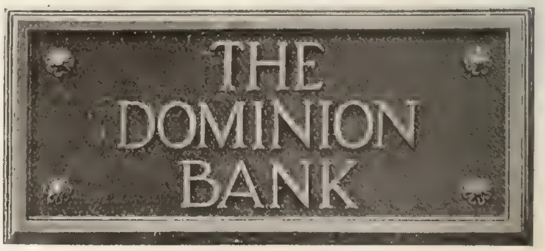

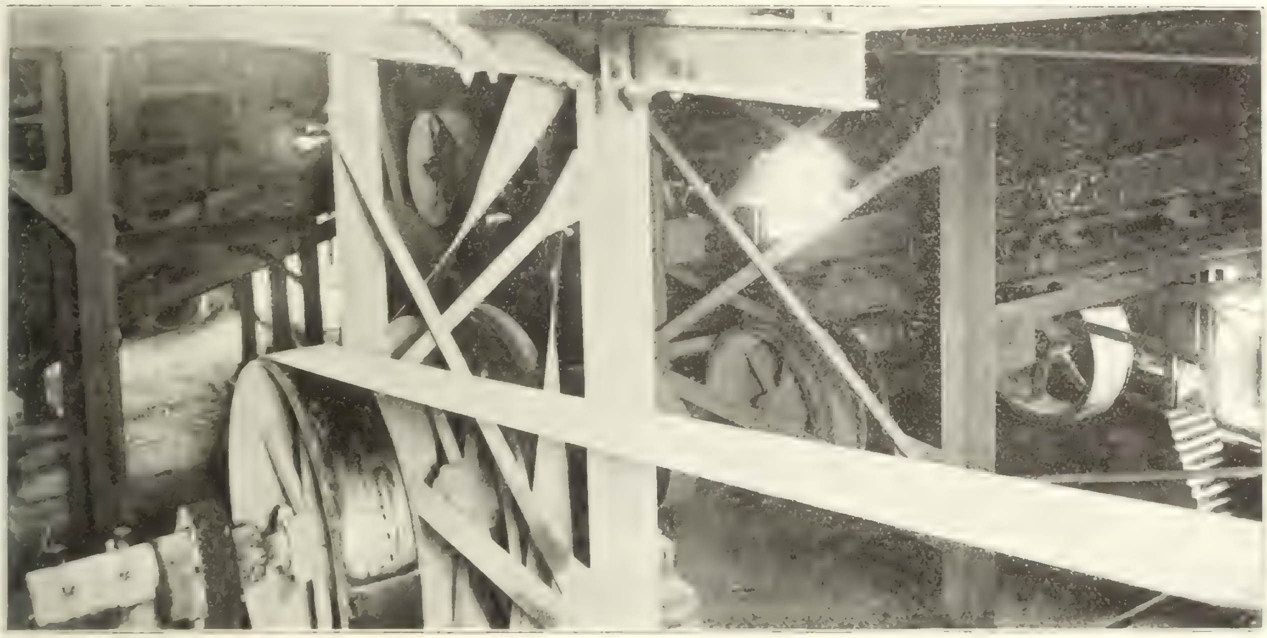

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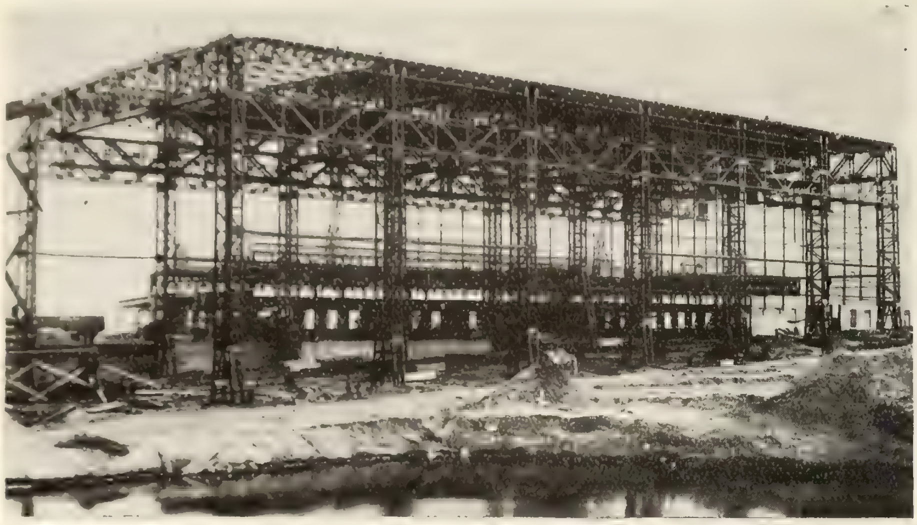

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British for British

If one were asked to give an example of the new avenues of trade which the war has opened up to the Canadian manufacturer, one could hardly cite a better instance than the supply of iron and steel goods. It is interesting to recall that during the fiscal year ended March 31 last, iron and steel goods imported into Canada from Germany amounted in value to $3,000,000, or nearly one-fifth of the total import of German goods into the country. A great assortment of goods goes to make up this amount. Tubing to the value of $539,000 and steel tires for locomotives to the value of $348,000 are included, as are also machinery to the value of $253,000, angles and beams to the value of $185,000, tools and implements worth $67,000, etc. A good slice of this trade should come to Canada and it rests with our iron and steel manufacturers to obtain and hold it.

We must not run away with the idea that the trade which the enemy countries have enjoyed with us will come to our manufacturers without the asking. There are keen competitors in the field—notably our friends on the other side of the border, who are displaying much enterprise in the matter of following up opportunities for new business at this time.

In the United States the various associations have had experts at work sizing up every phase of business changes and laying plans for the greater adoption of American-made products. As a single instance we recall an article in a Chicago publication setting forth the possibilities of introducing American-made pianos into Australia. The impression on the other side of the border is that the withdrawal of German competition in various lines of manufacture leaves the United States and Great Britain in possession—with all the advantages resting with the former, owing to the partial paralysis of British industries resulting from the war.

One cannot but pay tribute to the enterprise of our "American cousins," but we should benefit from the example they have set us and not pass up the opportunities which will be within our grasp only for a short time. Let it be remembered that the great bulk of Canada's purchases in Germany in the past have been comprised of finished manufactured products and that before the outbreak of hostilities trade was increasing rapidly. The war is a drastic measure of readjustment, but as a matter of cold fact it cannot but provide a stimulus to Canadian industry. Germany has been sending to Canada considerable quantities of iron and steel goods, hardware, electrical apparatus, scientific instruments, earthenware, glassware, etc., and it is now for the Canadian manufacturer to replace the German product. This can only be effected by great application and considerable enterprise, the combination of which cannot fail to promote the welfare of Canadian industry—moreover, in some lines the status of the industries will tend to a higher plane, as in certain lines—such as scientific instruments—where minute execution and exactness of finish are required, German manufacturers have established a reputation for careful and thorough workmanship. If there be a redeeming feature in the German character, it is the thoroughness with which the nation has improved its position in certain lines of manufacture during the last generation.

One may rest assured that in our day and generation there can be no recognition of German [illegible] and that any German-made article will spell anathema to all self-respecting Britishers. British manufactur ers the world over must combine to see that the trade suicide to which Germany has committed itself is executed to a finish; further, they should see that as far as possible German imports are replaced by British products.

Canada's situation is such that it must always be identified more or less closely in trade with the United States, and it is in the best interests of both countries for an interchange of trade to be maintained—indeed in many lines, particularly in the constructional field, we are yet dependent upon United States foundries; but in spite of this the principle of "British for British" must have loyal recognition from now on, even at the price of some self-sacrifice. The vain boast of "Deutschland uber alles" must give place to a world-wide recognition of British superiority in the whole category of human activities, in which manufacturing is one of the greatest considerations.

The Effect of Unbalanced Building Codes

THE lack of uniformity in the provisions of the building codes of cities in various parts of the country has resulted in an increased cost of construction for certain types of buildings, comments Engineering & Contracting, editorially. In one city the building code may specify low working stresses for reinforced concrete and comparatively high ones for steel construction, and vice versa, which naturally results in a preponderance of one type of construction almost to the exclusion of any other type. This condition limits competition to those engineers and contractors who specialize in only one kind of construction, and thus increases the cost of building construction in general. Monopoly, as applied to any kind of business, tends to increase costs to the consumer, and the construction business is no exception.

The need of more nearly balanced building codes—codes which do not unduly favor a certain type of construction—are greatly needed in many cities. The unit stresses which should be permitted are not a function of the particular part of the country in which the city happens to be located, yet a comparison of many codes might lead one to believe that such is the case. The officials of cities are not best serving the interests of these cities when they do not make determined efforts to secure balanced building codes.

To emphasize the importance of the above remarks the building status of an important eastern city will be considered briefly, the name of which is not pertinent to this discussion as similar conditions can be found in other cities. Although the following comment applies particularly to reinforced concrete construction, it may apply with equal force, in some other city, to another type of construction. In this particular city the extreme fiber stresses in concrete and steel are respectively 500 lbs. per square inch and 15,000 lbs. per square inch, the ratio of the modulus of elasticity of steel to that of concrete being 15, while the bending moment factor for intermediate spans is WL/10. It will be noted that these requirements are much more rigid than those of most large cities in this country. As a result, preference has been given to other types of construction, and the cost of reinforced concrete construction in this city is almost prohibitive. Capital is placed at a disadvantage, as compared with other cities, and the great progress of the city has been retarded. Even though this city requires the building public to adhere strictly to the provisions of its building code, yet the city itself, through its various departments, uses unit stresses of 650 lbs. per square inch in concrete and 16,000 lbs. per square inch in steel. It is thus seen that private capital is compelled to pay a bonus for this type of construction, although the city officials, in making public improvements, use the higher unit stresses.

Many of the provisions of building codes, notably those specifying allowable unit stresses, should be settled definitely by a commission composed of leading authorities in this country—men who will consider the subject broadly and who do not need to cater to the interests which are strongest in each city. The fact that the building codes of many cities are unsatisfactory is due mainly to the mistaken idea which has long existed that each city must solve its problems in its own way, which generally means that the strongest interests in each particular city are favored.

Reinforced Concrete in Municipal Engineering Work

SOME interesting observations anent the application of reinforced concrete to municipal engineering enterprises were made in the course of a lecture delivered recently in London by Mr. E. R. Matthews, Chadwick Professor of Municipal Engineering in the University of London. Prof Matthews remarked that the material was not a new one. Its discovery was claimed by the Germans, who, however, claimed many things which they had no right to do. Actually it was used one hundred years B.C. by the Romans in the covering of the roofs over their large tombs. The reinforcing material they employed consisted of bronze rods, but the concrete, they might be sure, was very poor compared with what we used to-day. About sixty years ago the French people took up the material very earnestly, and at the Exposition of 1867 there were a number of exhibits of reinforced concrete work. Since then the Germans had used a great deal of it. But America had been the leader; no country had used more, and the material was growing in favor as a result of the experience which had been gained. It had been used there for all sorts of purposes—often when it was inadvisable.

British engineers seemed to be rather conservative in their ideas with regard to adopting any new material, and it was some time before they looked upon reinforced concrete with favor; municipal engineers were now, however, commencing to use it a good deal. Some isolated cases of corrosion of the reinforcement had resulted in certain engineers refusing to employ it. He might say, however, that some years ago he carried out tests with a number of blocks of reinforced concrete about 1 ft. cube in size. Some of these were put in the sea at low water, others in fresh water, and a third set were left in the open air, and in no case did he find the least corrosion; in fact, reinforcing bars which, when put into the concrete were covered with red rust, when taken out were found to be quite bright. He once had occasion to take off the roof of an underground lavatory which leaked badly. The steel joists of this were embedded in concrete, but the bars showed no signs whatever of corrosion. He had found the same thing in a sea wall which he had to repair, and he thought such experiences tended to strengthen one's confidence in reinforced concrete. Corrosion did not bother him a bit, if the concrete was properly mixed and the reinforcing bars were thoroughly covered. He wished at the same time to utter one word of warning. Cinder concrete must not be used for reinforced concrete work, his experience of that being that, owing to the chemical action that was set up, corrosion occurred.

Prof. Matthews went on to refer to the use of reinforced concrete in the construction of sewers and aqueducts. Proceeding to deal with its advantages, he remarked that no material could be constructed more rapidly, the cost of maintenance was low, expansion and contraction were practically the same, and, of course, the concrete did not deteriorate, but increased in strength with age. He hoped the time would come when municipal engineers would adopt it more extensively, because he believed it was possible by its use to effect a saving o ffrom 20 to 30 per cent.

Corrosion of Steel in Concrete

SPEAKING on this subject some time ago, Dr. W. H. Walker, Director of the Research Laboratory of Applied Chemistry, of the Massachusetts Institute of Technology, said that every engineer is well aware of the fact that acidulated water, no matter how small the percentage of acid may be, tends to corrode steel by increasing the number of hydrogen ions present. It had been made clear, from tests he carried out, that there were certain alkaline substances present in concrete which corrected any acidity, and so protected the contained metal work from corrosion. This fact has an important bearing upon the question whether concrete will protect iron or steel from corrosion. Inasmuch as Portland cement, when it sets or hardens, liberates a quantity of caustic lime, which is a strong alkali, the answer to the question must be in the affirmative. Iron or steel will not corrode when embedded in good concrete. But caustic lime is soluble in water, and poorly made concrete is not impervious to moisture. Therefore, if iron be embedded in concrete through which water is allowed at any time to percolate, this calcium hydrate will be slowly but surely dissolved. With it will disappear the inhibiting action of the concrete; and iron embedded therein will, in time, rust and become corroded. To ensure absolute protection of the reinforcing members of concrete construction, therefore, such concrete must be of good quality, and sufficiently dense and carefully made to render it waterproof.

Disastrous fires at the docks along the Seattle water front have led to an ordinance providing that all docks constructed hereafter shall be provided with fire walls spaced not farther apart than 500 ft. on centers and firestops not more than 100 ft. apart. These provisions are not required in structures fully equipped with automatic sprinklers.

Causes of Concrete Failures

AT the recent annual meeting of the American Society for Testing Materials, Mr. R. S. Greenman discussed the causes of failures in concrete work. In classifying the reasons for failures, he said that of the known examples of poor concrete work 90 per cent. were due to poor workmanship, 8 per cent. due to poor aggregates, and 2 per cent. due to poor cement. He said further that "these reasons, and the additional one of the influences of the water used, are responsible for most failures."

From the nature of the subject under discussion, it is obvious that it is impossible to set exact percentages for each contributing cause to failure which will hold true for concrete work in general; yet approximate percentages may prove useful as a basis for determining the cause of any specific failure. In fixing the percentage due to poor workmanship, this value should undoubtedly be high, yet it is difficult to define what is meant by "poor workmanship" and what constitutes "good workmanship." What may be considered good workmanship for one type of structure (because it results in safe and economic construction) may not be satisfactory for a different structure. It is undoubtedly true that for most structures sufficient care has not been taken in the making and placing of concrete. When the essential element "time" is considered, it is probably true that concrete has not been given a fair trial. Concrete is usually made and placed at the site, yet these two distinct operations are made to compete with the erection, only, of other types of construction. Owing to this fact, it has been found impracticable to give concrete construction adequate inspection from start to finish. If sufficient time and care were given to the competent inspection of concrete structures, the 90 per cent. weight given to "poor workmanship" would be much too high.

Under present conditions, as pointed out by Engineering and Contracting, the 8 per cent. rating given to poor aggregates is probably too low. We are just beginning to realize the great difference that exists in the aggregates which ordinarily are available for concrete. As a rule, insufficient care is given to the inspection and testing of sand, broken stone, and gravel. Unfortunately we still find specifications which merely require that the sand shall be "sharp" and "clean"; yet tests have shown that "sharpness" is not essential, and that a small percentage of foreign matter is not particularly objectionable, provided it does not form a coating on the grains. More care is needed in the inspection of broken stone and gravel, while standard methods of testing these materials are needed.

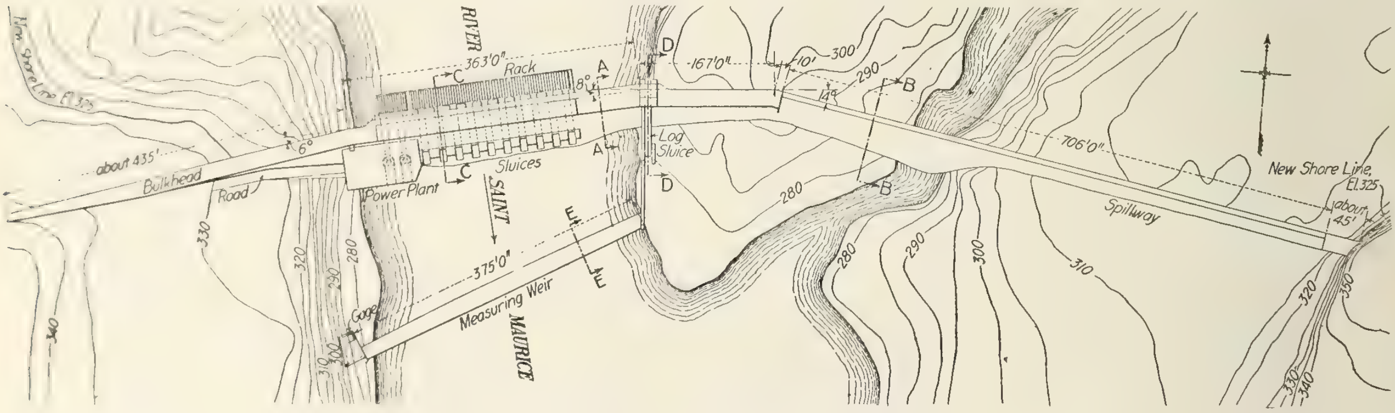
Although a careful examination of failures will usually determine the cause of failure, what is more generally needed is a better appreciation of the good results which will follow from increased attention to the selection and proportioning of concrete mixtures and to the mixing and placing of concrete. We believe that the lessons to be drawn from a study of existing failures will emphasize, mainly, the importance of factors which are (or should be) commonly understood by those now in charge of concrete construction. For example, the continued practice of specifying a definite concrete mixture, without first determining the properties of the aggregates and the proportions which will give a mixture of maximum density, is not justified by facts.

Proposed Water Storage on the Upper St. Maurice River, Province of Quebec

Main Features of Reservoirs of 160,000,000,000 Cubic Feet Capacity to Regulate the Flow of the River

By John Wolf Thurso, Civil and Hydraulic Engineer, Montreal

A CONCRETE dam to store the run-off from a basin of 3,650 sq. miles is to be built on the upper St. Maurice River in the Province of Quebec. Several years ago the St. Maurice Hydraulic Co. was formed by a number of companies owning and using water-powers on the St. Maurice River and by companies engaged in log driving on that stream. The object of the company was to regulate the flow of the river, specially to increase the low-water flow. Three timber dams have been constructed on the Manouan, a large tributary of the St. Maurice, forming reservoirs with a combined surface area of 100 square miles and a total capacity of 16,000,000,000 cu. ft. When the company applied to the Provincial Government for permission to create storage reservoirs of a much larger size on the St. Maurice River itself the matter was referred to the Quebec Streams Commission. The Commission advised that the government should have control of all such reservoirs, as there are quite a number of undeveloped water powers on this river not represented in the St. Maurice Hydraulic Company. In December, 1912, the commission was authorized to prepare plans, specifications and estimates, subject to approval by the government, which approval was obtained in December, 1913.



Plan of dam, showing relation of bulkhead, power plant, sluice gates, log sluice and spillway.

Hydrographic Conditions

The river has a drainage area of 17,000 square miles. It flows in a southerly direction and debouches into the St. Lawrence at the town of Three Rivers. The annual precipitation averages about 35 in. and the run-off averages 1.75 sec. ft. per square mile, or 67.9 per cent. of the precipitation. The dam site chosen is approximately 240 miles from the mouth of the river. The drainage area above that point is 3,650 square miles and the total fall from the site to the mouth is 1,278 ft. During the first year that records have been kept (May 1, 1913, to April 30, 1914) more than 170,000,000,000 cu. ft. of water have passed the site.

In 1912 the commission sent survey parties to ascertain the height to which a storage dam could be built without danger of spilling over into adjacent watersheds and to determine the capacity of the reservoir for such maximum height of the dam and the amount and quality of timber land to be flooded.

Three dam sites were investigated, the one finally chosen being 2.3 miles above La Loutre Rapids. To facilitate construction, a point where the river is divided by an island was chosen. This site is about 35 miles from the nearest point on the National Transcontinental Railway and about 50 miles upstream from the village of Manouan, where the Manouan River empties into the St. Maurice. Between the site and this village are seven rapids with a total fall of more than 115 ft., thus making river transportation of construction materials impossible. The whole country is extremely rugged. There are no roads. From the railroad the dam site is reached in summer by canoe with seven portages and in winter by dog sled. By either means the single trip takes two days.

The geological formation of the site and of the drainage area above is a gray Laurentian gneiss interspersed with (usually thin) layers of black hornblende and mica, the strata having a dip of about 45 deg. Here and there are small outcrops of a flesh-tinted granite. The whole surface is much eroded by glacial action. When the top soil is removed from the bedrock the glacial scratches are plainly visible and in some places numerous potholes are to be found.

In the spring of 1913 O. Lefebvre was appointed chief engineer and De S. Beaudry resident engineer, and a more exhaustive study of the location was started, consisting in clearing it of timber, digging trenches and test pits, making soundings of the river and core-drilling in the river bed. As expected from the geological formation, the bedrock proved to be of excellent character—hard, impervious and free from seams.

For the top of the dam and spillway crest El. 335 and 325 respectively were adopted, with provision for flashboards to El. 328. The lowest place in the river bed under the future dam body is El. 254. The zero datum for these elevations is 1,000 ft. above sea level.

Above the dam is a chain of lakes, with a present surface area of 209 square miles. Raising the level from El. 278—the present low water at the dam—to

El. 325 will cause the flooding of 95 square miles of land, bringing the reservoir surface to 304 square miles, with an available capacity of more than 160,000,000,000 cu. ft. With the water level at El. 328 (top of flashboards) the available capacity will exceed 185,000,000,000 cu. ft. It is not assumed, however, that the reservoir will be filled every year to its utmost capacity.

The three reservoirs on the Manouan are to be taken over by the Provincial Government and operated in conjunction with the La Loutre reservoir.

Design Considerations

In the design of the work the conditions were as follows: A reservoir was to be created having a capacity at least twice as large as the famous Assuan reservoir in Egypt, which since the recent raising of the dam has a capacity of about 80,000,000,000 cu. ft. The dam would be in a locality where the temperature drops to minus 60 or 70 deg. Fahr. and the range is about 160 deg. An ice sheet at least 3 ft. thick and the corresponding expansion forces must be reckoned with. The site is in the wilderness, 50 miles from the nearest settlement and at times almost inaccessible. It would, therefore, be difficult to obtain good men for the small staff of five or seven men required for operating the works,' while, on the other hand, it would be impossible to keep them under proper supervision from the commission's offices. For this reason everything should be as nearly fool-proof as possible, and machinery and apparatus liable to breakdowns should be installed in duplicate.

The first matters to be considered were the assumptions on which the design of the dam body was to be based. Five different types were investigated and estimates made.

Almost nothing of practical value has been published in regard to ice pressure, but a fact brought out by G. G. Bell before the Maine Society of Civil Engineers in 1911 was that a sheet of ice, when frozen to the sloping deck of a dam, will exert its full force upon that deck and will ultimately crush in the body of the ice, instead of shearing along the deck surface, no matter what the angle of slope of the deck may be.

It has been decided that the sluice gates should have a maximum capacity of 18,000 sec.-ft. under a head of 8 ft. This quantity is only to be fed out when a log or ice jam is to be broken or a belated log drive, stranded in some shallow spot in the river, is to be floated off. It was also determined that there should be an open sluice way reaching down 30 ft. below the spillway crest, to be used for passing logs and floating rubbish through the dam, and that provision should be made for a fishway.

General Design

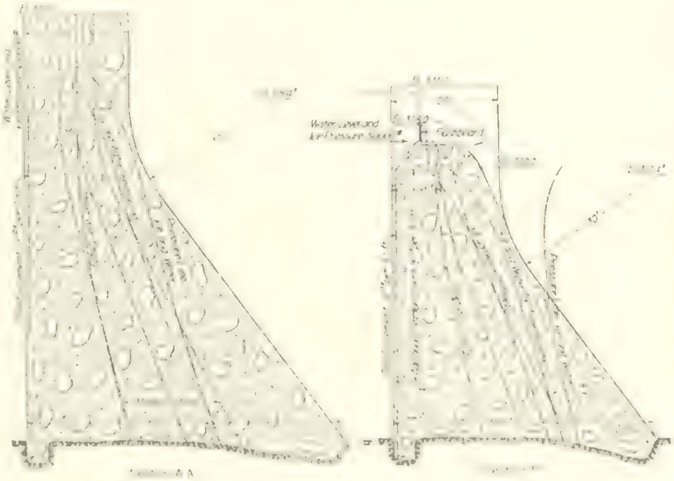
The east and west ends of the dam were swung downstream in order to shorten the structure and bring the line of the dam at right angles to, and the gate tunnels parallel with, the direction of the river. This left 167 ft. of the dam on the island on the original line. The extreme western end was later swung still further downstream, as investigations had shown that bedrock was to be found at a higher elevation along this final line.

It was decided that a solid concrete dam would be best and that an ice pressure of 50,000 lb. per linear feet applied at the elevation of the spillway crest should be assumed, while the uplift under the dam might be neglected. As the pressure line for this profile of the bulkhead section adopted falls outside the middle third, 1-in. square twisted bars were added near the upstream face to prevent a failure similar to those at Bouzey, France, and Habra, Algiers, both of which dams snapped off at about the middle of their height. The spillway and the sluice-gate section were similarly reinforced.

For all concrete a proportion of 1:2½:5 was adopted, large stones to be embedded in all work of sufficient dimensions to permit this. Soft steel, brought by twisting to about the strength of medium steel, was chosen for the reinforcement and a permissible stress of 16,000 lb. per square inch was assumed.

The demanded sluice-gate capacity required a total gate opening of 900 sq. ft., obtained by providing ten gates 7½ x 12 ft. placed 20 ft. on centres.

Below the dam a measuring weir will be built. It will be placed at an angle with the dam to obtain a greater length of crest and form an approximate right angle with the direction of the river. The most important object, however, of this weir is to form a water seal for the gate tunnels, as in winter the gate leakage would otherwise freeze in the tunnels and choke them with ice. The weir will also keep the water up to the turbine draft tubes and form a water cushion to absorb the speed of the discharged water, which at the gate end of the tunnels will be about 55 feet when the reservoir is full. The weir crest is at El. 278 (summer low water) so that it will usually be submerged. It will still be easier to measure the quantity discharged from the reservoir by thie weir than by the amount of gate opening, owing to the varying water level in the reservoir.



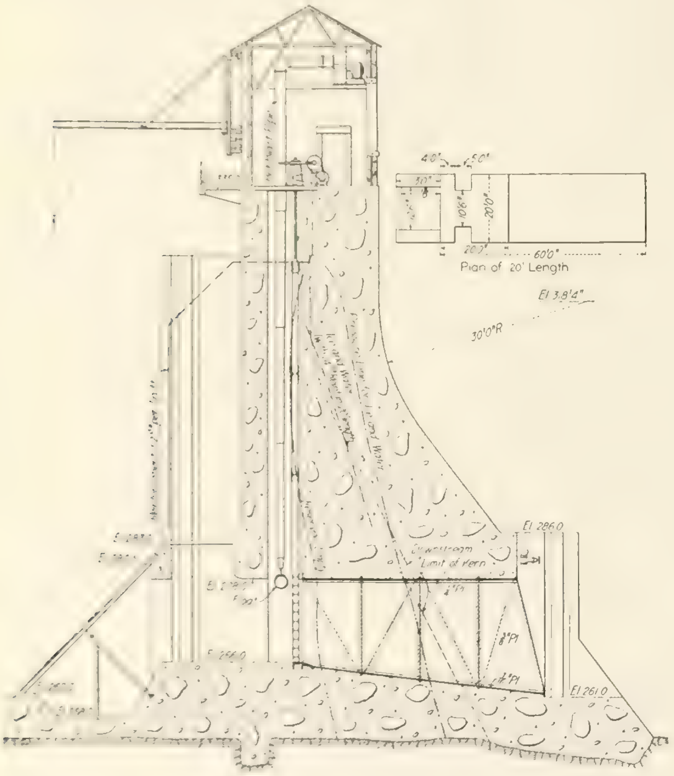
Typical sections of bulkhead and spillway portions of dam.

A spillway length of 696 ft. (fifty-eight 12-ft. flashboard sections) was adopted in order to confine the spillway discharge to the east channel and avoid carrying floating rubbish into the basin above the measuring weir. With 6 ft. of water over the flashboards the spillway discharge would be about 35,000 sec.-ft., while the ten gates could discharge about 45,000 sec.-ft. The spillway is, therefore, only an extra precaution. The only spring-flood measurement available shows a maximum flow of 14,500 sec. ft.

Especially during the first few years it is expected that a large amount of floating matter will be brought down from the flooded timber lands. To get rid of this, an open sluice is to be provided, with a steel channel, the upstream end of which is adjustable to the water level in the reservoir. This channel will also be used for floating logs through the dam, and if a fishway is required temporary wooden steps may be placed in it and a wooden extension added to its downstream end reaching down to the water level.

The power plant is to furnish current for lighting, and for operating the sluice gates, jib cranes and fans, but especially for generating heat. As the cost of coal would be at least $25 per ton at the site, and cordwood from the drainage area above the dam would not be dependable, it was decided to do the heating by electricity. Turbines not only require less attendance than boilers, and as water has to be fed out anyway in winter, there will be no waste of water by utilizing a small part of it for the development of power.

There will be two double-runner turbines of 180 h.p. each under a minimum head of 15 ft. and running at 200 r.p.m. One is a spare unit. As the head on the turbines may rise to 50 ft., and the power-house floor had to be kept 8 ft. above the crest of the measuring weir, or at El. 286, trouble with the draft tubes is to be expected, especially with small loads on the turbines. To obviate this the lower end of each tube is to be provided with a butterfly valve, so that the total head may be throttled down to 15 or 20 ft. effective head. The valve is hand operated, while the speed of the turbines is regulated by oil-pressure governors.



Section through one of the sluices, showing heating conduit.

Two return tubular boilers 60 in. in diameter by 16 ft. long will be provided to carry a steam pressure of 125 lb. They will have grates arranged for burning cordwood. The reinforced-concrete chimney curves along the downstream face of the dam and extends 40 ft. above its top. A vertical, cross-compound, non-condensing engine, with a maximum output of 180 h.p. and running at 300 r.p.m., is to be placed at the end of the line shaft and connected thereto by a friction coupling.

The line shaft, running at 300 r.p.m., is supported by concrete bases and so arranged that it can receive power from either turbine or the engine and transmit it to either generator. These generators each have a capacity of 100 kw. with an overload capacity of 25 per cent. for 2 hours; they run at 500 r.p.m. and generate direct current at 250 volts. One of the generators is a spare unit. Power from the turbines and to the generators is transmitted by Renold's silent chains submerged in oil-bath gear cases. A 5-in. vertical centrifugal pump set into a pit is provided to pump out the gate tunnels for inspection or repairs.—Engineering Record.

Hammer Drill Used in Cutting Pavement with Concrete Base

INFORMATION as to the use of a hammer drill in breaking up pavement having a concrete base is supplied by J. H. Henning, Salt Lake City, in Engineering and Contracting, as follows:

On an asphalt pavement repair job in progress in Salt Lake City, Utah, the contractor, J. P. Moran, has been using a hammer drill for this purpose. The economy of the use of a tool of this kind when working along a street car track, where a picking gang is subject to constant interruption by passing street cars, is apparent.

The method used in making these cuts was as follows: A line marked one foot from the car tracks was channeled through the asphalt with a Sullivan DC-19 drill operated by one man, a special fan-shaped channeling bit being used. When a sufficient distance had been channeled a gadding bit was substituted and the asphalt removed from the concrete base. The exposed concrete base was broken up with the same bit, holding the machine in a nearly vertical position. The concrete was broken into pieces from 4 in. to 8 in. square, which were readily thrown out by hand or removed with a shovel.

The drill broke up an average of 1 sq. ft. of asphalt and concrete in 2½ minutes. By the old method three men with sledges and picks averaged 1 sq. ft. in 6½ minutes, or 19½ minutes per man per sq. ft. removed.

The drill was operated by steam obtained from a compressor mounted so that it could be dragged along the street and supplied with steam by a portable boiler.

A rough estimate of the cost of similar work, using slightly different equipment and a comparison with hand labor costs, is given below:

Machine Work		
Cost of plant, including one "WK-3" 20-h.p. portable air compressor, operated by gasoline engine and two "DC-19" hammer drills, hose, steel, blacksmith tools, etc., about	$2,000.00	
Interest on plant, at 6 per cent.	120.00	
Depreciation, 15 per cent.	300.00	
Total plant expense per year	$420.00	
Operating expense, 175 days per year, (per day $420 ÷ 175)	2.40	
Engineer's wages per day	3.50	
Two drill operators, at $2.50 each	5.00	
Gasoline, 20 gals. at 23 cts.	4.60	
Oil, waste, etc.	.50	
Daily cost of operating	$16.00	
Progress per day of 8 hours, 384 sq. ft.		
Cost per sq. ft.		$0.0416
Hand Work Cost		
Six laborers at $2.25 per day	13.50	
Progress per day, 8 hours, 144 sq. ft.		
Cost per sq. ft.		.0937
Saving in cost per sq. ft., by use of portable air compressor and hammer drills		$0.0521

The annual report of the Water Commissioner of St. Louis states that there are comparatively few leaks in the concrete pressure conduit, which is 1,885 ft. in length and 7 ft. in diameter, which led from the basins to the pumping station at the Bessels Point water intake in St. Louis. All concrete used for repairs is of gravel with cement and sand in such proportions that one sack of cement produces 4½ cubic feet of concrete; 12 lb. of hydrated lime are added to each sack of cement, and the mixture is retained in a batch mixer for three minutes.

An Eleven-Mile Lumber Flume in B.C.

For the transportation of lumber from otherwise inaccessible districts in the logging regions, the Adams River Lumber Company, Limited, of Chase, B.C., have under construction a flume which, when complete, will be eleven miles in length. This flume, an illustration of which is given herewith, will tap a recently acquired timber berth of about 25,000 acres. At the present moment the flume has been constructed for a distance of about eight miles and it is reasonable to add that its operation will be an important asset to this enterprising lumber company. Among the advantages to be gained by its use are better facilities for the economical transportation of logs from this limit than have been at the disposal of the company from its old limits on Upper Adams River. Another outcome of the arrival of the flume is the elimination of the drive on Lower Adams River which will follow as a result.

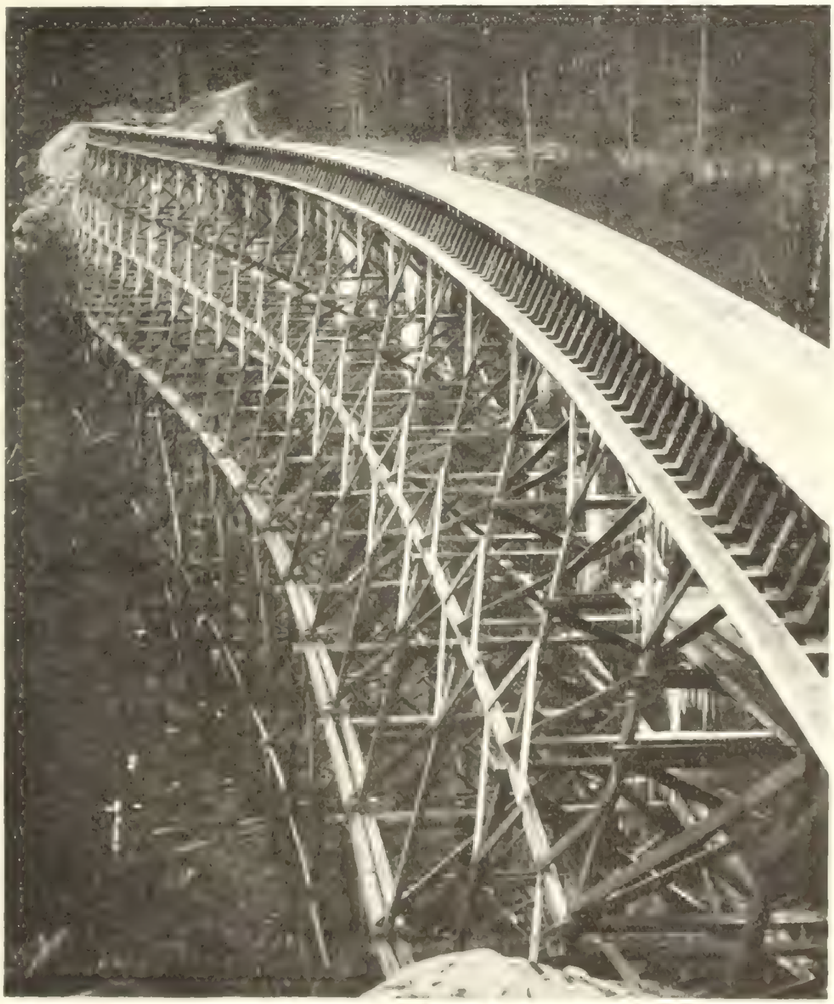
The maximum curvature of the flume will be 10 degrees. The grade will vary from 2/10 to one per cent., where the flume leaves the head works on Adams Lake, to a maximum of 16 per cent. in Bear Creek Canyon. The curves have been held down to permit the transportation of 80 to 100-ft. poles and piling. Most of the timber will be handled direct into the flume from log chutes. The flume will be extended into the timber as it is logged, in much the same way as logging railways are extended to follow the cutting. The erection of the flume is under the supervision of Mr. W. D. Starbird, of Spokane, Wash. The section shown in the illustration was constructed by Mr. J. H. Tracey, the firm's woods superintendent.

The Adams River Lumber Company have also constructed a dam which creates two small lakes to supply a head of eight feet of water for fluming purposes. It is said that as a result of the opening up of the new limit, about one-half of the output of the company's saw and planing mills is now fir, the balance being cedar, spruce and pine.

A good-sized irrigation undertaking in Texas will be placed under contract on December 1. The work is to be done for the Ward County Irrigation District, of Barstow, Tex., and will include the construction of about 40 miles of canal and about 15 miles of levee, the building of a dyke or levee at the reservoir site and the construction of two dams in the river, head gates, sluice gates, etc. The contract work will amount to about $325,000. The contract will be let with the provision that the successful bidder shall purchase the bonds of the district.

Bonding Asphalt to Concrete

Among the several problems to be met in the recent construction of the concrete reservoirs in San Francisco was that of bonding asphalt to concrete. According to Mr. B. N. Abbott, after making unsuccessful attempts to apply the asphalt direct to the concrete in various ways, the expedient of first painting the surface with coal-tar was tried, and it was found that when applied in this way under right conditions the asphalt would adhere so firmly that after it had cooled it could not be broken away without bringing pieces of concrete with it. Mr. Abbott states that in order to secure this result the concrete surface was first scrubbed clean with a bristle brush, and over this a thin coating of hot coal-tar was "painted." The coal-tar should be heated in small quantities, brought just to the boiling point, and then applied immediately. Heating the coal-tar in large quantities, which necessitated some delay before it could all be used, did not give such good results, and the men were, therefore, not allowed to heat more at a time than they could apply quickly as soon as it began to boil. The asphalt was spread over the tarred surface in the usual manner.



A part of the eight-mile flume of the Adams River Lumber Company

A 14-mile tunnel through the Caucasus mountains has been proposed by a Russian committee. This tunnel would shorten the distance between Waldikawkas and Tiflis by about 90 miles.

The Engineer as a Factor in Modern Warfare*

(An article in which Lt.-Col. Jos. E. Kuhn, Corps of Engineers, United States Army, discusses the organization, duties and equipment of the technical troops of the German army under actual service conditions.)

WHILE the titanic struggle now raging in Europe is engaging the attention of the whole world, it may be of interest to learn a little of the part played in military operations by the engineer's art. In a matter so serious as war, involving the very existence of states, it is inevitable that advantage will be taken of every resource of the arts and sciences and that engineering must obviously play an important role. In fact, the very character of warfare is profoundly affected by the achievement in the several fields of engineering. To cite a few instances only, warfare on the scale now witnessed in Europe would be impossible without the transportation facilities of the railroads and of mechanically propelled vehicles, nor could such enormous masses of troops be directed and controlled by one master mind without the aid of the telephone, telegraph and wireless. The achievements in metallurgy and machine design have produced the modern gun and rifle which have profoundly influenced battle-field tactics.

Classes of Technical Troops

It must be plain that the engineer's art plays no inconsiderable role in the equipment and transportation of armies, but the part played during actual campaigning, with its incidental marching and fighting, is perhaps not quite so apparent. Briefly stated, campaigning consists in overcoming obstacles, sometimes natural, but more often due to the enterprises of the enemy. On the march the principal obstacles are poor or impassable roads; in battle it is the fire of the enemy. While it is the duty of every soldier, irrespective of his branch of service, to assist in overcoming the obstacles encountered in campaigning, certain obstacles can best be met by men with technical training and technical equipment. To meet this situation, the organization of all modern armies provides for contingents of technical troops. These technical troops are frequently differentiated as pioneers, pontoniers, railway troops, telegraph sections, etc., according to the special technical work entrusted to them.

In the German Army, which may be taken as an example, the various technical duties in time of war are divided between two classes of troops, one the corps of pioneers and the other the communication troops (Verkehrstruppen). The former are strictly combatant troops, who march and fight with the infantry, cavalry and artillery. The latter have charge of the railways, telegraph, aircraft and mechanical transport in the immediate sphere of military operations. As the limits of this article will preclude any extended description of the duties, equipment and organization of all the different classes of technical troops embraced in the German military system, only the pioneers will be further considered.

Organization and Equipment

To each army corps, which is the largest permanently organized unit, there is assigned normally one pioneer battalion of 250 men. One company is attached to each of the two divisions constituting the corps, while the third company is under the direct orders of the corps commander. All pioneer companies are armed and equipped as infantry in addition to which each man carries on his person a portable work tool, there being 45 picks, 110 shovels, 58 axes, 22 hatchets with a few other tools to each company. Besides the portable tools carried by the men each company has a four-horse tool wagon carrying an assortment of digging and cutting tools and a varied assortment of supplies, such as rope, wire and nails and a two-horse demolition wagon carrying about 900 lb. of explosive.

Additional equipment for the use of the pioneer companies is found in the bridge trains accompanying each division and corps of the army, the personnel of which is furnished from the train, except that the corps bridge train has attached to it a detachment of pioneers for the care of the equipage. The divisional bridge train comprises 15 wagons carrying pontoons, trestles and flooring, sufficient for constructing 35 yd. of bridge. The corps bridge train comprises 34 wagons for carrying bridge equipage, sufficient for 136 yards of bridge. By combining the material of the divisional and corps bridge trains each army corps of about 25,000 men has sufficient material for the construction of 208 yards of normal bridge. The bridge trains do not ordinarily march with the pioneer companies but form part of the divisional and corps trains, being brought up when occasion requires.

Still further technical equipment for the use of the pioneers consists of the searchlight sections attached to each army corps. The latest pattern of searchlight equipment is a horse-drawn electrical projector carriage, the motor and generator being carried over the front axle and the projector with its telescopic mast and cable reels being carried over the rear axle. When in use the projector axle is uncoupled from the generator axle, enabling its light to be set up at any point within a radius equal to the length of cable.

In addition to the foregoing normal organization and equipment of pioneer troops for army corps and divisions special fortress and siege units of pioneers are formed on mobilization as occasion requires. These units are ordinarily regiments of two or three battalions equipped with a pioneer siege train carrying intrenching, mining and other tools, building materials, electric searchlight plant, explosives and storming apparatus. The organization of the siege train varies with the nature of the operations in view.

The recent tendency in the German Army is to increase the proportion of pioneers assigned to corps and divisions and certain corps have already had their contingents of pioneers doubled, being provided with a regiment of two battalions.

The pioneers are selected from recruits possessing a knowledge of mechanical trades such as carpenters, smiths, masons, miners, riggers, or such as have knowledge of boating and boat building, the latter in view of the importance of bridge operations. The period of training of the pioneers is two years, the same as that of the infantry. Besides being well grounded in the duties of an infantry soldier, the pioneers are thoroughly taught their special technical duties, the principal of which are bridge building, fortifications and demolitions.

The crossing of an unfordable stream in the face of opposition by an enemy is one of the most difficult and dangerous of military operations and one in which the pioneer plays a most conspicuous part. Upon his technical skill, nerve and daring depends the success of an attack or the safety of a retreat, and when the undertaking is handicapped by swift currents and by the fire of the enemy, the pioneer's task is indeed a most trying one. In European terrain, intersected by numerous streams and canals, bridging operations are of common occurrence in campaigning and, even if there were no other engineering features in war, these operations alone would call for technical troops and equipment.

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* Abstracted from the Engineering Record.

During an advance a section of pioneers always marches with the advanced guard to repair or improve roads and to remove obstacles created by the enemy. During an attack, especially on fortified positions, pioneers accompany the advance of the storming columns for the purpose of clearing the way. In this work high explosives play a leading part. On the defensive the pioneers assist in the work of fortifying the ground, clearing the foreground of obstructions so as to permit of a clear field of fire, constructing obstacles, such as wire entanglements and mines, building or improving the communications in rear to permit of the ready movement of troops and artillery and erecting special structures, such as bomb-proofs, observing stations, dressing stations for wounded, etc. If villages or towns are to be defended, the pioneers loophole the walls, barricade streets, and provide direct communications inside the lines by breaching openings through walls and buildings.

During retreats the pioneers are charged with blowing up bridges, damaging railroads, destroying stores and practising similar operations designed to delay the movements of the enemy. As time is the all-important element high explosives constitute the principal reliance. The best military explosives are those which are of solid form and of shapes which will permit of their being rapidly and conveniently assembled into larger charges. Picric acid or trinitrotoluol in the form of blocks or cylinders are the most suitable explosives and the ones almost universally employed for military purposes.

Sapping During Sieges

In sieges the duties of the pioneers become of paramount importance. Here the trench work must be largely done by them by the slow and tedious method of sapping which consists in the excavation of the trench at its head in a manner similar to that of driving a tunnel. When the enemy's forts are reached, mine shafts and galleries must be driven under them and the works finally blown up. It is hardly necessary to state that this work is exceedingly dangerous under the concentrated fire of the enemy and his countermoving operations and that the casualties of the pioneers will be heavy.

The foregoing reference to the duties of the engineer troops in campaigning by no means exhausts the list. It must be apparent that they have no easy task, for they must not only march and fight with the other troops, keeping abreast of them at all times, but must frequently execute laborious tasks for the benefit of their comrades, tasks which, though highly important, are less romantic and glorious than the charge and the hand-to-hand encounter.

The fundamentals of military engineering do not differ from those governing civil practice. There is, however, this difference—the results sought are as often destructive as they are constructive, and economy in a financial sense must yield to economy in time, which is the all-governing consideration in military operations. The military engineer is, however, handicapped in his operations by an absence of all the labor-saving and efficient machinery and the variety of adaptable material at the disposal of the civil engineer. He must, therefore, be all the more resourceful in turning to his purposes the scanty resources immediately at hand. One material he can always find in unlimited quantity and that is earth which, in fact, constitutes his principal building material supplemented by whatever timber, wire, stone that may happen to be handy. One thing in which the military engineer has an advantage over his brother in civil practice is that he need not worry over property rights. Under the stern law of military necessity he is free to help himself to anything which will answer his purpose and without fear of consequences.

The Field of the Slow Sand Filter

It is generally admitted that the field of the slow sand filter is narrowing while that of the rapid sand, or mechanical filter, is widening. Granting this we believe many readers will appreciate something definite to which to tie in choosing between the two types for a given locality. The choice will naturally rest in any case upon the comparative cost and efficiency of the two types. The question of cost is readily worked out by the designing engineer and the efficiency to be expected will depend upon the characteristics of the raw water to be filtered. Definite figures on the latter point were proposed as a guide by Mr. Robert Spurr Weston of Boston, in discussing the paper on "Present Day Water Filtration" read by George A. Johnson before the latest annual convention of the American Water Works Association. The following matter is quoted from Mr. Weston's discussion:

Each locality has its problem and should attempt its own peculiar solution. Undoubtedly, many slow filters were built and installed where rapid filters should have been chosen. Pittsburgh and Washington, D.C., are cases in point, and which have occurred in the writer's practice, but there are other cases where slow filters are not only more economical but more efficient than mechanical filters, and some of these cases are where high rates of filtration may be employed without detriment, because it is obvious that the cost of slow filters per million gallons decreases rapidly and inversely with the rate of filtration.

Generally speaking most engineers who are competent in the field of water purification, that is, those who have studied the problem for a long time in connection with many types of waters, are agreed that mechanical filters are best where the color is over 50 parts and the turbidity over 30 parts per million, or where there are unusual fluctuations in the character of a stream, which ordinarily is but slightly colored or turbid. Again, there are other cases where the water is so clear that there are no nuclei to start the coagulation of the applied chemical, upon which coagulation the efficiency of mechanical filters depends. To use mechanical filters in these cases may necessitate the addition of clay or other suspended matter to produce an artificial turbidity, or the use of an excessive amount of coagulant, so that the coagulant will precipitate by virtue of its large mass.

Before this paper was written the speaker made some studies of the comparative costs of slow sand and mechanical filters for presentation at a town meeting, and came to the conclusion that an average cost of $14,500 per 1,000,000 gals. for mechanical filters and a cost of $100,000 per acre for slow sand filters were good average figures. These figures are higher in the case of mechanical filters and lower in the case of slow sand filters than given by Mr. Johnson. In Mr. George W. Fuller's report on the Montreal Water Supply, dated July 22, 1910, the cost of sand filters was estimated at $33,840 and mechanical filters $21,091 per million imperial gallons daily capacity. The cost of slow sand filters per million gallons varies with the rate, as the following tabulation, assuming covered filters and appurtenances to cost $100,000 per acre, shows:

Rate of filtration mgd.	Cost of mgd.
10	$10,000
6	16,667
5	20,000
4	25,000
3	33,333
2.5	40,000

The cost of mechanical plants generally varies with the character of the water, and the writer believes the estimates in the following tabulation represents the best practice in plants of moderate size. The costs include the necessary subsiding and coagulating basins; also small filtered water basin or pump-well:

Character of water. Turbidity of color.		Cost per mgd.
0 — 100	or 0 — 25	$14,000
100 — 300	or 25 — 75	16,500
300 upwards	or 75 upwards	18,500

The above costs are higher than those of the largest and best plants constructed under favorable conditions, but lower than those of plants where unusual conditions prevail.

A mechanical and a slow sand filter, each of 1,000,000 gals. daily capacity, designed and constructed under the speaker's supervision during 1913, cost $16,000 for the mechanical and $18,000 for the slow sand plant. The cost of engineering for the mechanical filter was unusually high and the slow sand filter was in connection with a deferrization plant, where the costs included a coke trickler, 15 ft. high and 30 ft. in diameter, and where the filter operated at 10,000,000 gals. daily rate.

In the paper under discussion many references have been made to the hygienic efficiencies of plants treating waters which have been disinfected with chlorine, and in many cases these have been compared with waters which have not been so treated. The cost of sand filtration depends upon the rate. In the early days, as will be remembered, slow filters were designed at rates of 2,650,000 gals. per acre per diem, and less, this rate being the German official rate of 100 vertical millimeters per hour. If bleaching powder be used to sterilize the effluent, there is no reason why this rate cannot be raised much higher than 6,000,000 gals. per acre, which is the maximum in ordinary present day practice.

Apart from the cost and efficiency factors in some cases, the speaker is in hearty agreement with the conclusions of Mr. Johnson's paper, namely, that the mechanical filter is an efficient and reliable sanitary machine, one that will reduce the death rate due to water-borne diseases. It is true that the zone in which slow filters are used is narrowing, while that in which mechanical filters are used is broadening, but the speaker still contends that there is still a field for the slow filter, namely, where clear waters have to be purified and where local conditions make the cost of water furnished by the slow filter less. In comparing the efficiency and economy of the two types, one should use the same basis. One should not compare the efficiency of filters where the effluent is sterilized with those where no sterilizing chemicals are used.—Engineering and Contracting.

English Specifications for a Bituminous Concrete Mixing Plant and Details of the Acceptance Test

An abstract of the specifications used in purchasing a plant for preparing bituminous concrete and a description of the acceptance test used is given by W. H. Grieves in a report to the Urban District Council of Surrey (England) published in the London Surveyor. The adaptability of the plant to work in hand is also discussed.

Plant Required

The following is a short specification of the plant for bituminous material:

One Coleman's patent stone and sand drier, consisting of one 5 to 6 h.p. gasoline engine, with water tank and fittings complete; one drier and furnace capable of drying and heating to a temperature of at least 400 degrees F.; stone, slag, sand, clippings, or any other similar material for bituminous road making, and including all pulleys and fittings and elevator. The whole mounted on a steel frame, lock, steel wheels and axles of sufficient strength to carry the required load. The machine to be fitted with brake and draw-bar.

The total output of bituminous compound of the above machine is guaranteed to be approximately 40 to 60 tons per day, according to weather conditions.

One Coleman's mixer, mounted on steel frame, forecarriage and lock with steel wheels and axles, the mixer elevated to a sufficient height to allow the material to empty into a cart.

One enclosed elevator for lifting the material into measuring bin, with the necessary raised platform for men to work upon.

One 10 h.p. gasoline engine, with water tank and fittings.

One small hand winch and wire rope for elevating bitumen.

One measuring bin of 1,000 to 1,500 lbs.

Brake fitted, and mixer supplied complete with draw-bar. The above machine is capable of thoroughly mixing the material with the bitumen at the rate of about 1,500 lbs. in three to four minutes.

The total cost of the machinery would probably be about $4,500.

The main idea is that the sand should not only be absolutely dry, but it must be heated to a temperature not exceeding 180 degrees C.

Work to be Accomplished

Assuming that the machine could be worked 150 days in the year at 40 tons per day, it would turn out 6,000 tons per annum. Allowing for 1 foreman, 2 men feeding the machine, 2 mixing, 1 man at the bitumen tank, 1 engine driver, 2 men wheeling, 3 men laying the material, the cost of sand, bitumen and filler, and adding charges for maintenance, haulage, depreciation, depot rents and steam rolling, the cost per ton would equal about 50 to 60 cents per square yard.

The cost of the main roads already repaired amounted to over $30,000. There still remains to be repaired, on the main roads, an area of 24,870 sq. yds., which, at $1.20 per square yard, would cost $29,844. Putting the cost of the new method at the higher figure of 60 cents per square yard, this would amount to $14,922, effecting a saving of about $15,000, or more than enough to pay the cost of the machinery three times over. The machinery could also be used for mixing tar or asphalt macadam, and for this purpose stone taken up from other roads could be used in addition to new stone.

The following test of the machinery was made at the manufacturers' works in the presence of a subcommittee appointed by the council for the purpose:

Wet sand was put into a measure 3 ft. 6 in. square by 9 in. deep, and then put into the drier, and immediately came out of the drier at a temperature of 360 degrees F. Within 5½ minutes 750 lbs. were put through the machine, and came out at a temperature of 600 degrees F.

A second lot was put in, to which 4 gals. of water was added to the already wet sand, and within 1½ minutes this was turned out of the machine at a temperature of 500 degrees F. The temperature of the wet sand before it was put in was 70 degrees F. One man fed the mixer with 750 lbs. in seven minutes. Ordinary sand on a dry day was then put in, and the 750 lbs. was passed through the machine in 3½ minutes at a rising temperature of over 400 degrees F. In the combined stone and sand drier 2 tops of wet limestone macadam were put through the machine, and after remaining in the same for ten minutes, came out at 470 degrees F.; 2,100 to 2,200 lbs. of sand were passed through this machine in 8¼ minutes, and came out at a temperature of 465 degrees F.

This mixer will discharge 1,000 to 1,500 lbs. in three minutes.

Stone revolves in this machine at the rate of 14 miles per hour, and sand at the rate of 25 miles per hour.

Bricklaying Costs for 5 to 10-Ft. Brick Sewers at St. Louis, Mo.

An attempt to standardize bricklaying methods in sewer construction so as to secure the greatest efficiency at each step of the work was recently made in St. Louis. The contract on which this attempt was made was for the third section of the Glaise Creek Joint Sewer, which was carried out by the American Contracting Company. This contract consisted of 7,370 ft. of brick sewer, varying from 5 to 10 ft. in diameter and from 13 to 18 in. in thickness. The total amount of brickwork was 10,264 cu. yd., consisting of 9,600 cu. yd. common and 664 cu. yd. of vitrified-brick masonry (to line the invert for the dry-weather flow).

It was found that by planning the work so that a certain number of bricklayers could be constantly employed, the best men could be kept. The importance of this feature is nearly always underestimated by contractors. The difference between the work done by a good man and an average man is at least 10 per cent., and where full time can be made the very best men are obtainable.

The next step was to get the maximum of work from the bricklayers. This meant not harder work, but eliminating lost motion. The essentials were proper working room, sufficient materials in the right place, and safe working conditions. Solving each of these problems required much experiment. Too many or too few bricklayers in a given space was found to be equally expensive. Materials in the right quantity, just when needed, make it unnecessary for a $9-a-day bricklayer to wait for a $2.50 laborer.

The principle of "safety first" was found to be of more importance than merely a humanitarian measure. Accidents demoralize efficient work, and a little extra care and expense along this line will more than pay for itself. For example, brick baskets were used instead of slings, and only material immediately to be used was allowed on scaffolding.

The elimination of useless labor was one of the greatest problems. Mortar was mixed by machinery at a cost of less than 1c per cu. yd. for power. Great care was taken to have this mortar of just the proper consistency. It was found that, everything else being equal, the day's work could be increased 2 or 3 per cent. by having the mortar exactly right all the time. The mortar was dumped directly from the machine into barrows and then poured into chutes. Thus the bottom man had only to direct the mortar into the boxes below. Mortar mixers and mortar lowerers were stored as close to the ditch as possible and in the same quantity as would be used in that length of sewer.

The job was started November 4, 1913, and finished August 18, 1914.

The cost data are based on the following prices for labor and material delivered:

[illegible]	$1.12	[illegible]
[illegible]	0.31	[illegible]
[illegible]	8.50	per M
[illegible]	16.50	per M
[illegible]	1.40	[illegible]
[illegible]	0.80	[illegible]
Electricity	0.10	per kw.hr.

The constants for each cubic yard of brick were:

430 common brick at	$8.50	$3.66
338 vitrified brick at	16.50	5.58
[illegible]	1.40	0.91
0.35 cu. yd. mortar at	0.85	0.30
0.10 kw.hr. at	0.10	0.01

The mortar was 1 part cement to 3 parts sand.

This makes the material cost $4.88 per cu. yd. for common and $6.80 per cu. yd. for vitrified-brick masonry.

The monthly records were as follows:

		Cubic yards laid			Cost per cu. yd.		
Month.		Common	Vitrified	Per day of 8 hr. per bricklayer	Labor	Total common	Total vitrified
Nov.,	1913	[illegible]	[illegible]	9.3	$2.25	$7.13	[illegible]
[illegible]	1913	1144	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1914	[illegible]	87	[illegible]	1.90	6.78	8.70
[illegible]	1914	[illegible]	[illegible]	12.0	[illegible]	[illegible]	[illegible]
Mar.,	1914	[illegible]	[illegible]	[illegible]	1.90	6.78	8.70
[illegible]	1914	[illegible]	[illegible]	[illegible]	1.78	6.66	[illegible]
May,	1914	[illegible]	[illegible]	[illegible]	2.24	7.12	[illegible]
[illegible]	1914	[illegible]	[illegible]	9.9	2.26	7.14	9.06
[illegible]	1914	[illegible]	[illegible]	[illegible]	1.77	6.65	[illegible]
[illegible]	1914	[illegible]	[illegible]	[illegible]	2.65	7.53	[illegible]

[illegible] yd. per bricklayer [illegible]		[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
	Vitrified	8.82

The high cost of labor in May is due to tunnel work at night, when double time was paid to bricklayers. The high cost for June is due to bad working conditions, where frequent cave-ins caused much delay. The last month's figures are not significant, as the best men had left for other jobs and lots of cleaning up was necessary.

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* By C. L. French, St. Louis, Mo., in the Engineering Record.

Comparative Costs of Three Types of Foundation Construction

THE Boston & Maine R. R. has recently completed the construction of a very large group of shop buildings at Billerica, Mass., comprising in all 10 large structures. This is one of the largest railroad shops in New England.

The soil conditions on the site of this work consisted of a surface soil of sand and peat underlaid by a water bearing sand. When the engineers were considering the design of foundations for these buildings they investigated three types of construction, viz.:

1. Concrete piers carried down in open caissons to firm strata.
2. Wooden piles cut off at ground water level and capped with concrete piers.
3. Concrete piles driven from the surface of the ground and capped there.

A comparative estimate of cost of the above three types of construction showed a very large saving in favor of concrete piles, and this type of construction was actually used.

COMPARATIVE COSTS

Concrete Pier

Excavation, pumping and backfill	$ 90.00
Sheeting and bracing	100.00
Concrete, 18.5 cu. yds. at $7.50	138.75
Total cost	$328.75

Wooden Pile Pier

Excavation, pumping and backfill	$ 40.00
Sheeting and bracing	60.00
Concrete, 17.5 cu. yds. at $7.50	131.25
16 wooden piles at $5.00	80.00
Total cost	$311.25

Concrete Pile Pier

Reinforced concrete cap (including excavation), 6 2-3 cu. yds. at $9.00	$ 60.00
8 concrete pedestal piles at $15.00	120.00
Total cost	$180.00

The design for a typical pier in this work based on the three above mentioned types of construction is given in Fig. 1, and the accompanying table gives the estimated cost for the foundations of this typical column for the three types considered. These comparative designs and estimates show the method by which in any particular case investigation may be made to determine which is the most economical type of foundation to use.

Contract for the foundation, including piles and capping, was let to the MacArthur Concrete Pile & Foundation Company. About 3,000 pedestal concrete piles were driven, together with a large amount of reinforced concrete capping.—Concrete Cement Age.

The Cedar River dam at the water supply for the city of Seattle, Wash., was finished November 2, and two days later the rock tunnel was completed. The expenditure for the work has been $1,470,000. The storage basin has a capacity of 5,200,000,000 cu. ft. Preliminary work was started July 1, 1910, and the work was under the direction of the city engineering department up to July 1, 1913, when a contract for completion was awarded to the Nettleton-Bruce-Eschbach Company for about $700,000. The height of the dam is 160 ft. above the bed of the Cedar River and its length at the crest is about 1,000 ft.

In a Belgian publication, Union des Ingenieurs de Louvain, the possibilities of cement in a new field are brought out. Who would have ever thought that there would be anything in common between the automobile industry and that of concrete masonry construction? Yet the supposition is not so strange and is verified in the statement of a recent experiment that has been made by one of the leading carriage concerns in Paris which is building its automobile bodies out of a plastic amalgam of concrete and cork poured around a metallic trestle stretched between wooden frames corresponding to the architectural lines of an automobile body. When completed this body does not differ from those in ordinary use, but this method of manufacture permits the lines to be better established, the angles to be rounded and makes practical a body much lighter than does the ordinary wood and steel construction.

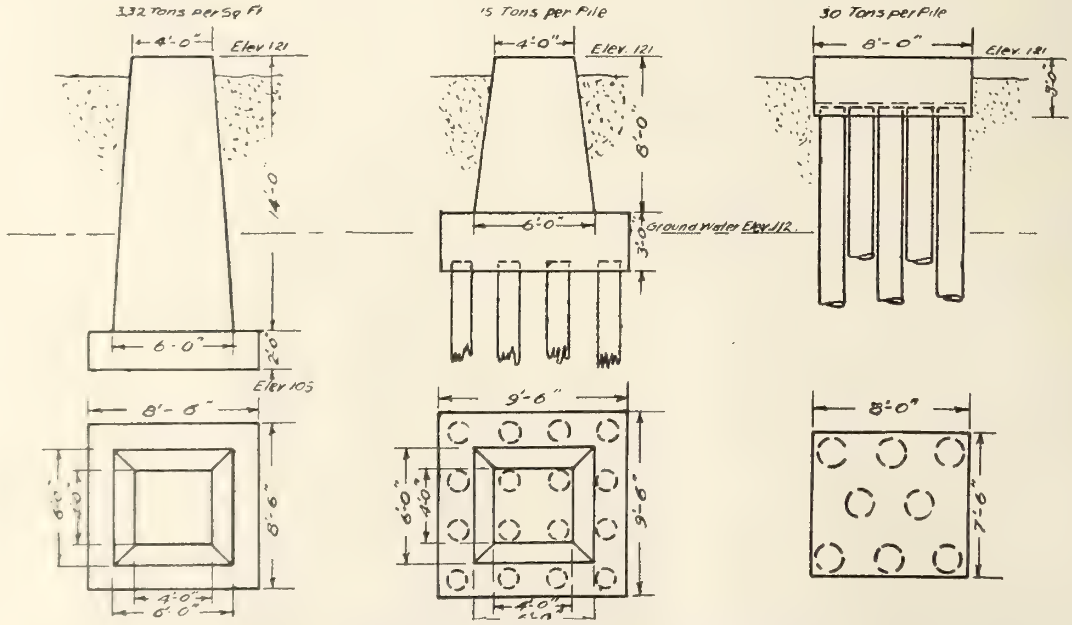

Fig. 1—Comparative design for three types of foundation construction.

The Value of System in Contract Work[*]

Details of Organization Which Make for Success—Advantage of Timing Construction—Suggested Form of Sub-Contracts

HOW does a successful contractor plan his work—by days—by weeks—by jobs? To tell that, in detail, is itself a pretty big contract, and isn't the easiest thing in the world to do; but I have handled a few big contracts in my time, and this may not be too difficult.

I am the senior member of a more or less successful contracting firm in a certain good-sized city on the Ohio River; and while we haven't got everything figured down to the finest possible point, yet there are a number of things which might be said to constitute our system, our plan, of doing business, and which we never deviate from.

To begin with, the work is divided between my partner and myself, according to that which we can do best. He is possibly the better superintendent, and he therefore attends to all the outside work, making the round of all jobs which we have under construction, seeing that material is on the ground and the like—all the numerous details that come up and have to be seen to, in spite of the fact that we have a capable superintendent. I handle the office, making up estimates, attend to the payment of bills, the correspondence, and all that sort of thing. And we are both kept busy enough, too. I don't mean that I never oversee any of the work, nor that he never makes a contract or helps figure and estimate on a job; but I do mean that we make it a point not to be on the same job, at the same time—that's where the system comes in.

We figure that one of us can do a thing, in most cases, just about as well as both of us together could do it, and that it would therefore be poor business to waste the time of one of us helping the other to do a thing which he could do alone. The only exception to this is one hour of the day—the noon hour. We make a rule to lunch together whenever it is practicable, because we have found it a good idea to get together at that time, when things are somewhat relaxed, and have a talk while we eat. It's a good time to untangle little matters that have come up, and then each can get any advice he wants of the other. It is a sort of council of war, where plans can be laid and courses of action decided upon, whenever necessary; and we both go back to work feeling that we are not alone—that we have a good man behind us!

Then, we always save some time that others waste, not to mention incidental damage to materials, by not being in too much of a hurry to start on a job. That may sound somewhat peculiar, but it is the exact idea I wan to convey. Very frequently, in fact, nearly all the time, as soon as the plans and specifications are complete and the contract is made, the owner is in a wild rush for the work to begin. He sees no reason for an instant's delay, and is utterly unable to understand why the fool contractor stands around with his hands in his pockets and waits for days and possibly weeks, before beginning the job.

The point is, of course, that we are not standing around with our hands in our pockets, by any means. Why begin excavation on a medium-sized or small building in such a time that it will be finished long before your foundation material could be on hand, and be caving and possibly filling with water in the meantime? Or, what is more usual, why complete your foundation, and have your basement open to the weather, before you have completed arrangements for the delivery of frames, so that the job can go right on up? The same thing applies where there is any particular kind of brick to be used, especially, of course, if it is in the nature of a special order. And mill work should be ready at the time when it is needed, in order to prevent delay in the work, having men on your hands idle half of their time. That sort of thing eats into profits, and is entirely useless. A little foresight is all that is necessary. The delivery of every scrap of material can be arranged for in advance, to be on the ground just when it is necessary, according to a definite program; and yet I have seen builders who neglected this first essential to a successful job.

Where the material required is such that it has to be ordered specially, and always where it must come from out of the city, I take particular pains to see that there will be no hitch in delivery—that is, none that will leave me without legal recourse. If it is a small quantity, I usually order it at once, and have it delivered, as the certainty of having it on hand makes the immediate investment worth while. If it is a large quantity, however, I make a formal contract, and have a penalty clause just like that which is contained in our contract with the owner, so that if the factory, or quarry, or whatever it is, falls down on its contract, we are protected.

It goes without saying that we have at hand on each job complete detailed plans and specifications, ready for reference all the time. In addition to these, however, we also have a complete set of the sub-contracts made, so that the superintendent and foreman on the job can at once ascertain what sub-contractor is responsible for any part of the work or material, at any time the information becomes necessary.

A Suggested Form

Our sub-contracts, by the way, are made up on a form which we have devised, which we think is pretty good. On one side we have a short proposal blank, running about this way, with date-line and address: Gentlemen:

We propose to furnish all materials and labor and do the .... for the .... job, or building, located on ....street, between .... and .... streets, being No..... in the City of ...., County of .... and State of .... said work and materials to be in accordance with the plans and specifications as prepared by ...., Architect, and in order that there may be no misunderstanding, we will further state (here is a blank space for such further remarks as may be deemed necessary). For the sum of .... Dollars.

We agree, upon written notice from you, to start the work within .... days after receipt of said notice, and push said work to completion as rapidly as possible.

The blank has space for the sub-contractor's signature and an acceptance line for us. On the other side of this form are eight ruled spaces, all just alike, under the following printed lines:

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[*] By G. Crain, Jr., in The National Builder.

"Received of (our firm) partial payments on account of work and material as per contract on the reverse side as follows:"

And in each space is room for the date, signature of the firm, and the amount of the partial payment. At the bottom is a slip, which can be detached by a perforation, in which to sign a receipt and release in full, when all payments are made. The detailed statement of partial payments is filed alphabetically under the name of the sub-contractor, with all other matter relating to his contract, and the slip is turned over to the owner, or placed in his file, as evidence that the property is clear of liens on the part of sub-contractors.

It might be mentioned here that there is but one check-book out of which drafts are made on the firm account, and that is kept in the office. Our pay-roll, of course, is handled by one check, and the men get their money in cash, in the usual pay-envelope. I have known contracting firms, though, who never knew where they stood on a job, because two or three members were issuing checks here and there, and it was simply impossible to keep any track of them.

We have a bookkeeping system which enables us to know to a cent what a job has cost us, and that is considerably more than some men know; and yet it is absolutely necessary, in order for the contractor to find out what his profit—or loss—is, as the case may be. We have three ledgers, in one of which is recorded all that we buy, with the credits to us by return of material and cash payments; in another, the materials put into the job, and payments made to sub-contractors for work and material; and in the third, our accounts with the owners. There are appropriate accounts in the first two ledgers for every head under which expenditures on a building may fall, and not a cent is spent for even carfare that is not properly charged. When we get through a job we know just what we have spent, and we know just what we have spent it for; we know what we have received in payment for the work. And from these facts, it isn't hard to discover just how we stand on the job.

Securing Good Work from Men

HOW do you make men work?" a prominent contractor was asked recently. "I don't make them work," he replied—and that is probably the reason of his success with men—they work of their own accord, work because they respect him and because they like his treatment of them, his sympathetic though firm leadership, his loyalty and fairness. There are all kinds of men and all kinds of results to be obtained from employing them. Some are profitable for their employers, others are not. Many are willing to work and some willing to shirk and the difference betweeen working and shirking is frequently the difference between profit and loss for the employer, says a writer in Building Progress.

All employers are concerned about the same proposition—how to make profit out of men. Many in business for years have not discovered the way to make labor pay, though other employers have solved the problem comparatively easily. Why does one firm get good work out of its men when another firm is always up against it when it comes to labor? Why is it that one employer has no labor troubles and another is in hot water all the time though apparently both treat men equally well? The first requisite for loyal labor is being loyal to yourself. No man who hires another can expect to get any better treatment than he gives, and if he shows a disposition to treat his men any less than well he may reasonably expect poor work from them. Almost every builder has at one time or another been a hired man and he need take but a few moments of reflection to recall the jobs he held which were of most profit to himself and his employer. Any builder who can call back to his mind some of the early jobs before his own shingle was hung out will remember that he did the best work for that employer who treated him with most fairness, and this work, you may be sure, was profitable for employer and employed.

Contrary to the opinion of many, labor is practically an exact science. Wages are fixed in advance and every builder of experience knows about how much work he may expect as the result of each day's labor. In checking labor items this is the first computation to make—how much is a fair day's work? After having done this, contractors should expect good, average efficiency from every one in their employ, well up to the standard day's work they know men are capable of, under right conditions. Mechanics who drop below this efficiency will bear watching and a builder should keep tab on his men to the extent that he may know whether they are keeping up to the mark or not. Many contractors, recognizing the necessity of examining into the efficiency of their men, keep a card index record of each, marking every man a certain percentage at the end of every week's work.

There are various ways to keep men up to their right degree of efficiency. Many builders have found it pays to watch carefully to see that no workers are taking unnecessary steps or using false motions in executing work. One builder discovered that the lengthening of a gangway, making it one plank longer, produced 30 wheelbarrows of concrete a day more than formerly, as the gangway was made less steep and men could heap the barrows, carrying more at greater speed. Workmen had made this gangway themselves, but with poor judgment. When the change was made they were themselves pleased, as it took less effort to climb up. Mixing concrete by machinery is now known to be the best way to get the largest amount of material properly mixed, and the installation of a concrete mixer has put dollars into many a builder's pockets besides earning him the gratitude of his men. Even after a mixer is installed one builder will produce his concrete at less cost per yard than a competitor, because he scientifically arranges a scaffolding so that loading and unloading is as automatic as possible. One machine properly arranged will eat up a constant string of wheelbarrowfuls of material, and it has been found in most localities that hand mixing is no longer profitable, however cheap labor may be.

The foreman is the key to many a builder's bank account, though frequently builders do not realize it. An efficient, loyal foreman is the most important acquisition to any contractor's staff, and when a foreman is secured who is really a winner the contractor had better love him like a brother. Probably more wrecks in the contracting business are caused by inefficient foremen than from any other cause. Your foreman can be so firm so long as he is fair and yet be popular with men. In truth, workmen are inclined to respect firmness wherever found, firmness tempered with justice. It seems to be a characteristic of human nature everywhere to admire a real leader, and that is what your formen should be, a leader—a captain who gets the utmost efficiency out of the squad under his command, gets it by executive ability and tact.—Building Progress.

The Hennebique System of Ferro-Concrete Construction

A Description of Noteworthy Buildings Erected at the Coast, Prefaced by a Sketch of the Origin and Growth of the Pioneers of This System, Messrs. L. G. Mouchel & Partners

SOME seventeen years ago, the late Louis Gustave Mouchel, a former French Government Engineer who had settled in South Wales, undertook the introduction of the Hennebique System of Ferro-concrete into Great Britain and established the civil engineering practice which has been continued to the present day by his successors, Messrs. L. G. Mouchel & Partners.

In the early days of his enterprise, ferro-concrete was practically unknown in the United Kingdom and Mr. Mouchel had to encounter serious opposition, but this has long since been swept aside by the advantages attendant in the employment of ferro-concrete construction.

Among the first important works executed from the designs of Mr. Mouchel were Harbor Works at Southampton, granary and flour mills at Swansea, jetties and warehouses at Liverpool, and railway warehouses in London and elsewhere. During the first five years of his career as a ferro-concrete engineer, Mr. Mouchel secured commissions for the design and erection of some fifty structures, many of considerable magnitude, and the confidence engendered by these speedily led to the far wider use of the new structural material—a point clearly illustrated by the average record of about fifty Hennebique works a year during the three succeeding years, and the fact that over two hundred structures of the kind had been completed by the end of 1905.

An acknowledgement of ferro-concrete—and of its pioneer—was furnished in 1906 by Mr. Mouchel's appointment by His Majesty's Office of Works as their consulting engineer to be responsible for the structural work in the new General Post Office, London, comprising two huge blocks of buildings built entirely in accordance with the Hennebique system.

The total number of ferro-concrete structures completed by the end of 1909 amounted to some eight hundred. These included wharves, jetties, quays, highway and railway bridges, water reservoirs, sewage tanks and grain silos, as well as Government, dock, railway, municipal, industrial, commercial and residential buildings of every description.

Some time before the death of Mr. Mouchel, in 1908, his practice was transferred to a limited company and continued under the style of L. G. Mouchel & Partners, the present chiefs being Mr. J. S. E. de Vesian, M. Inst. C. E., M. I. Mech. E., and Mr. T. J. Gueritte, B.Sc., M. Soc. C. E. (France), two engineers who for a long time had been associated with Mr. Mouchel and Mr. Hennebique in the design and superintendence of many important ferro-concrete works in all parts of the country.

The present firm, in introducing the Hennibique

Belmont Building, Victoria, B.C. Mr. Hoult Horton, architect

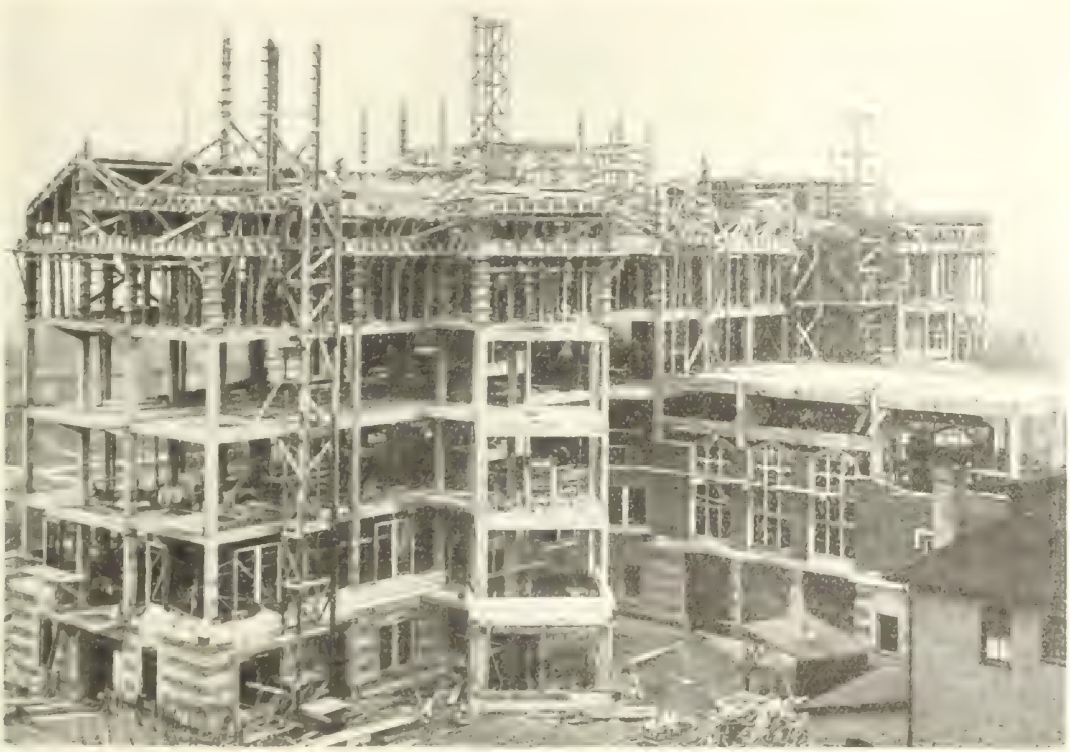
Birks Building, Vancouver, B.C. Messrs. Somervell & Putnam, architects.

system of construction in the United Kingdom and Canada, have adhered to the methods which contributed in great measure to the stability and permanence of Hennebique structures all over the world. Briefly stated, in the United Kingdom these methods comprise the maintenance of a technical organization with head offices in Westminster, and branch offices under the charge of qualified engineers in different parts of England, Wales, Scotland and Ireland, and the appointment of experienced contractors of the highest standing, by whom all works are executed and who are directly responsible to clients as well as to the firm for the satisfactory performance of their duties. Thus the staff in the chief technical office is able to concentrate its attention on the design of structures to be carried out, the various district engineers being engaged in the important work of superintending practical operations from the beginning to the end of each contract.

The year 1910 was noteworthy in the annals of the firm in two respects—one for the record number of over two hundred commissions for Hennebique works, and the other for the appointment of Mr. de Vesian as the engineer responsible for the design of the new bridge over the River Suir, at Waterford, Ireland. This appointment, made by His Majesty's Privy Council in Ireland, and confirmed by the Lord-Lieutenant, was followed by the construction of the magnificent ferro-concrete structure, 700 ft. long by 48 ft. wide, taking the place of the old timber bridge formerly providing the only highway communication between Waterford City and Waterford North. In 1911 the Portuguese Government appointed the firm consulting engineers for reinforced concrete works to their Colonial Office, and later they were appointed by the British Crown Agents for the Colonies in similar capacity.

An idea of the extent of the firm's operations is conveyed by the fact that at the end of 1912 nearly two thousand works had been completed on the Hennebique system in the British Isles alone, whereas the total number of Hennebique structures completed to that date amounted approximately to 27,000. These works include engineering and architectural works of

St. Paul's Hospital, Vancouver, B.C. Mr. Robert F. Tegen, architect.



St. Paul's Hospital, Vancouver, B.C., under construction

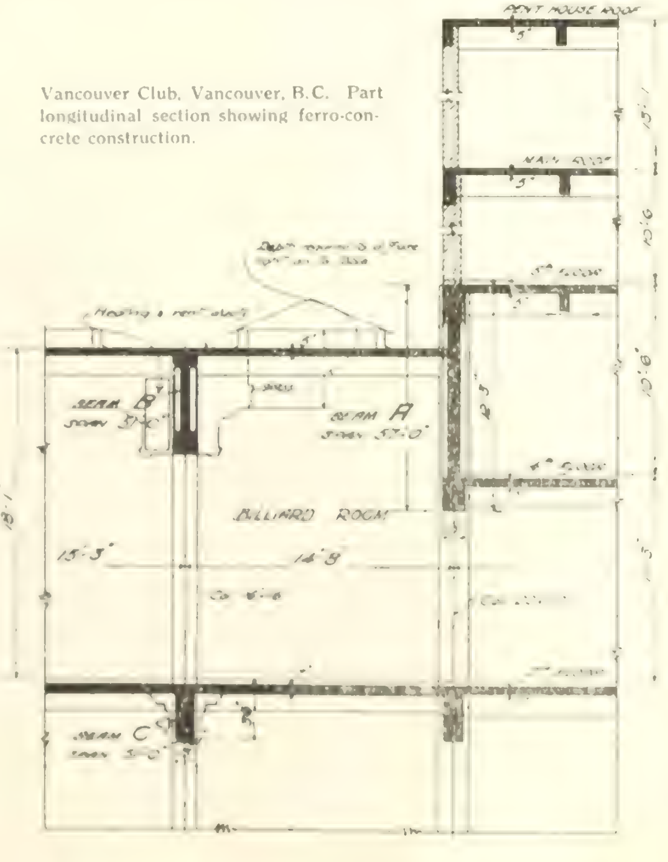
the most varied description and, in numerous instances, of unparalleled magnitude. Among them are found some of the finest examples of ferro-concrete construction of the present day.

It is interesting to note that the total number of bridges built to the end of 1912 was 1,744, as detailed in our last issue. In this number is included the Risorgimento Bridge over the River Tiber at Rome. This structure is 328 feet span and the longest span ferro-concrete bridge in the world. Another bridge worthy of note is a bridge at San Sebastian in Spain. This bridge is finished in black and white marble concrete, polished by hand, the design being of a highly ornamental nature.

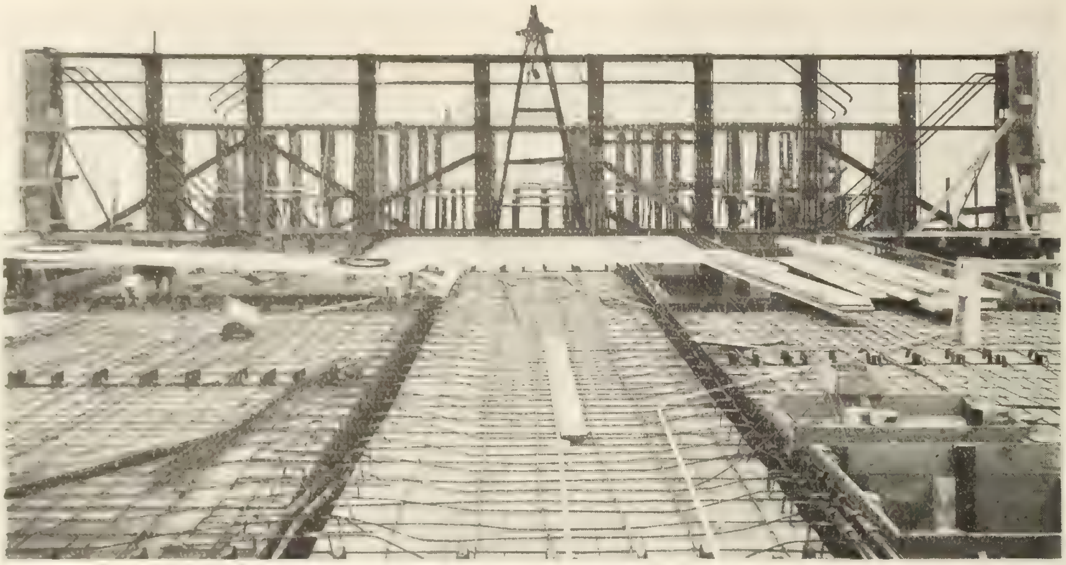
Among the works executed in the United Kingdom in addition to the new General Post Office, London, to which reference has already been made, we may mention extensions of the Manchester and Glasgow General Post Offices. Other Government buildings completed recently are the new premises of His Majesty's Stationery Office, and the new offices of the Board of Agriculture. The Royal Liver Building, forming a bold landmark on the shore of the Mersey at Liverpool affords striking evidence of the adaptability of ferro-concrete to buildings of the most monumental character, while the Manchester Dock Warehouses, nearly half a mile long, and the large grain silos, with the capacity of 1,680,000 bushels, now under construction for the Manchester Ship Canal Company, testify to the utility of ferro-concrete in commercial undertakings.

The wharves and jetties included in the project for the new Port of London Improvements have been placed in the hands of Messrs. L. G. Mouchel & Partners and have been designed in Hennibique ferro-concrete; also the firm have recently been appointed by the Dover Corporation as consulting engineers for the line of ferro-concrete viaducts and bridges extending right through the town, in connection with the improvement scheme formulated for the purpose of affording direct access to the harbour and new passenger station about to be built on the widened Admiralty Pier.

The Vancouver office of this firm has been responsible for a considerable amount of interesting building



Vancouver Club, Vancouver, B.C. Part longitudinal section showing ferro-concrete construction.



Vancouver Club. Reinforcement in place for ferro-concrete beam, 57 ft. span.

and engineering work. A few of the more important building features are described and illustrated herewith.

Belmont Building, Victoria, B.C.

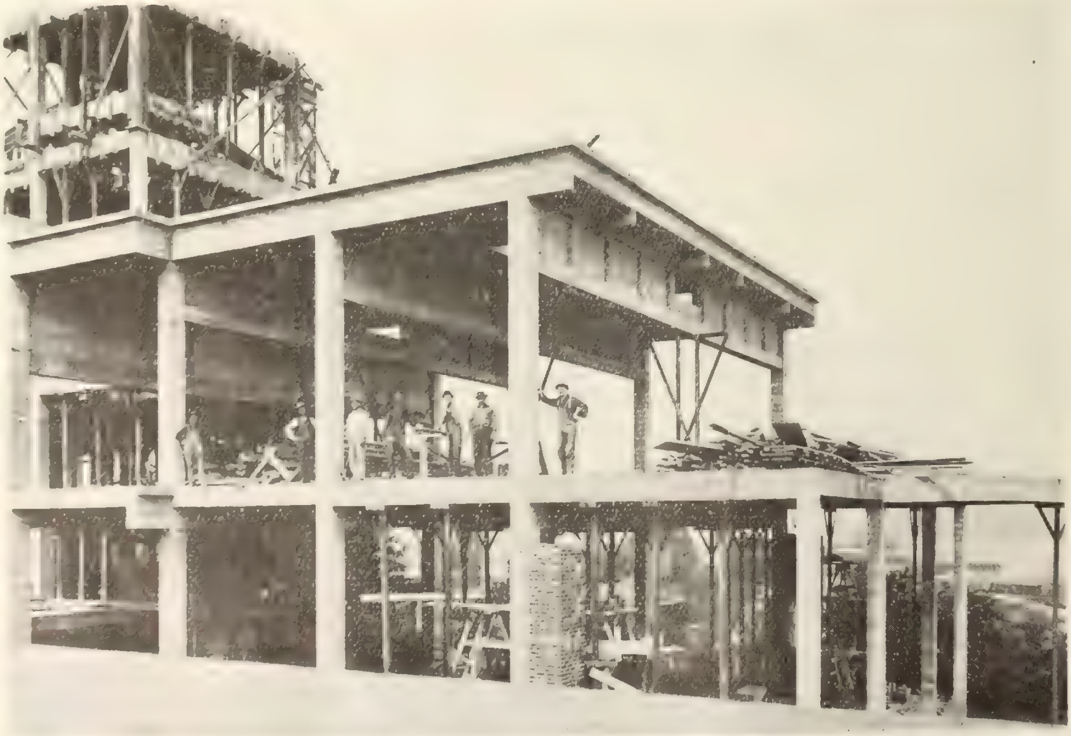
This building is the largest and best appointed office building in Victoria. It occupies a prominent position opposite the C. P. R. Empress Hotel, overlooking the inner harbour, bounded by Government, Gordon and Humboldt Streets.

The building is approximately 100 ft. by 136 ft. in dimensions, and has eight floors and a basement. The exterior facing is of buff terra cotta. Mr. Hoult Horton, of Victoria, was the architect.

St. Paul's Hospital, Vancouver, B.C.

The main building is 205 ft. by 45 ft., with central front wing of 52 ft. by 40 ft. There is a Chapel wing at rear and also two small lavatory wings. Connected to the main building by a ferro-concrete tunnel is a power-house and laundry.

This building was originally designed in steel, for which Hennebique ferro-concrete construction was substituted with considerable saving in cost. The complicated architectural features were not in any way affected or altered. The ferro-concrete structure accommodates the intricate terra-cotta work, heating and ventilation ducts, etc., without trouble, and the columns



Vancouver Club. Completed Ferro-concrete beams, 51 ft. span, in dining and billiard rooms.

occupy no more internal space than the steel encased in concrete. The roofs are entirely of ferro-concrete covered with metal tile.

Plate No. 3 shows the front of the completed building. The frame building on the left is the old hospital building which will be pulled down shortly. Plate No. 4 shows the ferro-concrete structure nearly completed. The architect was Mr. Robert F. Tegen, of Vancouver.

Birks Building, Vancouver, B.C.

This building is located at the corner of Granville and Georgia Streets, opposite the Vancouver Hotel. The site measures 100 ft. by 120 ft., and the building is comprised of ten storeys and a basement. The basement, ground and first floors are occupied by Messrs. Henry Birks & Sons, jewellers, and the remainder of the building is devoted to office accommodation. The chief point about the structural work is that after the structure was completed to the ground floor, the remaining nine floors and roof were completed in ten weeks. This, we believe, constitutes a record for Canada. The architects were Messrs. Somervell & Putnam, Vancouver.

The Vancouver Club

The Vancouver Club building occupies a site 184 ft. by 77 ft., and is located on Hastings Street, overlooking Burrard Inlet. The building is faced externally with terra cotta and light brown pressed brick. It is of the modern Renaissance style on the exterior and the same feeling is carried out in the interior.

The structure of five floors and basement provides accommodation for large dining room, ladies' lunch and tea rooms, billiard room (six tables), large lobby lounge, two visitors' rooms, card rooms, magazine and writing rooms, and twenty-eight bedrooms.

The nature of the site presented a difficult architectural problem to provide the large rooms unobstructed by columns, and to provide sufficient daylight to all parts of the building. This has demanded a building which, structurally, is one of the most complicated in Canada.

The solution of this problem by the architects, Messrs. Sharp & Thompson, of Vancouver, has been a very happy one, and the Vancouver Club building is regarded as one of the finest of its kind.

The structural work was originally designed in steel, encased in concrete, with reinforced concrete floor slabs. An alternative scheme in Hennebique ferro-concrete construction was prepared and accepted. This construction not only afforded a great saving in first cost, but on account of the adaptability of Hennebique construction to architectural features, great advantage was offered on this score.

The ferro-concrete columns shaped to come within the walls, etc., occupied much less internal space than the steel columns encased in concrete. The big panel beams in ferro-concrete shown in the construction merely take the place of walls in the building and are unnoticeable. They compare very well in efficiency with big steel box girders weighing many tons, which are very difficult to accommodate architecturally and are very costly. In Plate No. 5 there is shown a longitudinal section of part of the building to illustrate this point. The beam A is 57 ft. span, 12 ft. 3 ins. deep over all, and 15 ins. in width. The reinforcement of this beam is shown in Plate No. 6, and Plate No. 7 shows the completed ferro-concrete work.

The beams B and C are 51 ft. span and C is 36 ins. over all and 13 ins. wide. One beam C was tested as follows:—

One whole bay 51 ft. by 36 ins. was loaded to 100 lbs. per square foot, the superload to which it was designed being 80 lbs. per square foot. The deflection registered at this load was 17-64th of an inch = 1/2190 of the span. The test load of 100 lbs. per square foot was limited as no more material was available. About seventy-five tons of material were used in this test.

The structural work of the above buildings has been carried out entirely in Hennebique Ferro-Concrete to the designs and supervision of the Vancouver Office.

It may be of interest to state that Messrs. Mouchel & Partners are arranging to extend their activities in the Dominion. With this end in view they have opened a Toronto office (Mail Building) in charge of Mr. F. G. Engholm, A.M.Inst.C.E., A.M.Inst.M.E., their representative for Canada.

The firm's Head Office in the Mother Country is at 38 Victoria Street, Westminster, London. Their Vancouver office has been established some few years.

Wrecking Concrete Buildings

A FEW years ago no one gave much thought to such matters as the wrecking of reinforced concrete buildings to make room for new structures. At that time, concrete buildings were deemed permanent, and it was taken for granted that very few concrete buildings would ever have to be torn down. Progress in building has shown that concrete structures will in the future have to be wrecked to make way for modern structures. For this reason the following methods of wrecking two different concrete buildings, given by Cement World, will be of special interest:

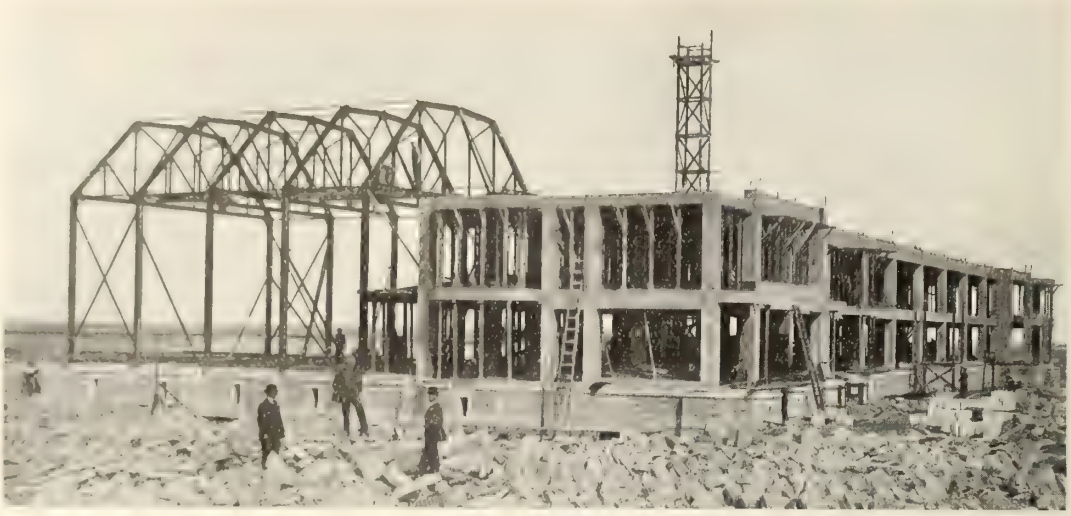
Wrecking with Dynamite

In wrecking a one-storey reinforced concrete building of the beam-and-girder type in Baltimore, recently, small charges of dynamite were used at the top and bottom of all columns, to sever them from the girders. The girders torn loose by the charge of dynamite, dropped to the ground and were readily broken up. The floor-slabs were broken up by means of heavy sledges before destroying the girder connections with columns. The dynamite severed the column connections; and, after dropping to the ground, they were broken up with sledges. The cost of wrecking this structure amounted to about $4.000 per cubic yard of concrete contained therein.

Wrecking by Oxy-Acetylene Torch

While building the new "Soo Line" freight depot in Chicago, it was necessary to wreck a four-storey and basement building used as a brass foundry by the Crane Company, to make room for the mammoth concrete structure upon which the freight yards and depots were placed. The building was of steel frame encased in concrete, with reinforced slabs between beams.

The oxy-acetylene torch was used to cut all structural and reinforcing steel; and, while so doing, it was discovered that the flame would cut concrete readily. For cutting concrete, it was found that acetylene and oxygen pressures of 20 and 50 lbs. per sq. in., respectively, produced the best results. Holes 2¾ in. in diameter were cut through an 8-in. concrete slab and two ¾-in. bars in 2¼ minutes. These holes were cut in the centre of panels, to give a starting point for the men working with heavy sledges who broke up the entire slab. The I-beams encased in concrete and supporting the floor-slabs were cut in 12 minutes. Under the action of the blow-flame, the concrete seemed to disintegrate as if it contained water.



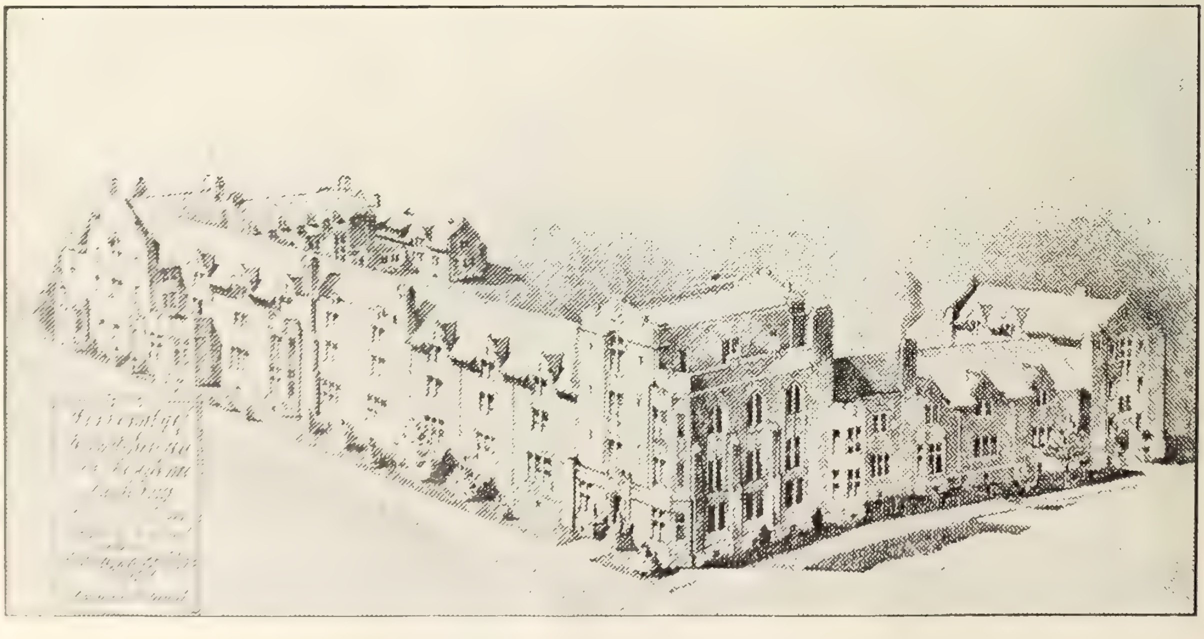
Saskatchewan University Residence under construction.

New Residence for Students of the University of Saskatchewan

By George T. Clark, C. E.

THE increase in attendance at the University of Saskatchewan has made it imperative that adequate facilities be provided for housing the students of the various faculties. With this object in view, the Provincial Government, on the advice of President Murray and the Board of Governors of the University, have at present under construction their second Students' residence. This building occupies a site on one of the ovals of the University grounds across the driveway from the present residence and in close proximity to the present main building of the University. The first residence was constructed about four years ago, and it is expected that it, along with the building now under construction, will accommodate the students in attendance at the University for a few years at least.

The new residence is of reinforced concrete construction. All the exterior walls are of rubble stone masonry laid up in roughly squared ashlar of local field limestone. This local stone is found in large quantities within a few miles of the University grounds and when built into the walls presents a particularly pleasing color effect. This is due to the fact that some of the stones are of a reddish-purple hue which seems



Architect's perspective of the complete scheme.

to diffuse itself over the surface of the whole wall. The trimmings are all of Bedford limestone. All the steps and platforms to entrance doors, base course and basement window sills are of Stanstead gray granite.

The whole of the desk and sloping roofs have timber studs securely fastened to the concrete. The tops of the studs are covered with inch lumber. The desk roof is then covered with tar and gravel and the sloping roof with first quality unfading green slate. The roof system over the dining room consists of steel trusses supported by steel columns set in the rubble walls.

The floors throughout the building are concrete slabs reinforced with Kahn bars. The finished floor in all bedrooms, lounge rooms, corridors and dining room is of clear quality maple. All lavatories, bathrooms, swimming tank room, promenades and stairhalls in basement are laid with terrazzo flooring. The doorways off lobbies, stair-halls and vestibules have thresholds of Italian marble, and the rooms with terrazzo flooring have marble bases and borders. All stairs are ornamental iron with marble treads.

The building is equipped with two elevators—one of fifteen hundred pounds capacity running from basement to attic, the other of one thousand pounds capacity running from basement to ground floor. Automatic doors control the entrances to the elevators at each door.

All outside permanent windows have sashes of rolled steel sections of Henry Hope & Sons' manufacture. These sashes are glazed with thirty-two ounce glazing glass. The panels of vestibules and outside doors are glazed with polished plate glass.

Heat, light and water are supplied to the new building from the central power house, and are conducted to it through a concrete tunnel.

The basement is divided into a large storage room, a common room, a swimming tank, shower room and dressing rooms. The swimming tank is fifty feet long by twenty feet wide and is ten feet deep at the deepest end. This is installed not only for the use of the students in this particular residence, but also to be used in conjunction with the gymnasium, which will be one of the most recent additions to University life. A large dining hall, a lounge room and bedrooms take up all the space on the ground floor. The first and second floors contain bedrooms and lounge rooms, while in the tower on the third floor is the hospital.

The architects for the University residence are Brown & Vallance, of Montreal. The local general contractors are Messrs. Richardson Builders, Limited, Saskatoon.

The contract price of the new building is $185,000. It is expected that the structure will be completed next spring.

Liquid chloride for water treatment at Milwaukee, Wis., is being considered as a substitute for the hypochlorite treatment now employed. The main reason is that in winter, when the lake water is very cold, the chemical reaction with hypochlorite is not the same as in water of ordinary temperature, and as a result it is impossible to avoid taste in the treated water. This causes complaints from consumers, some of whom fear the water is unfit to drink. It is expected that the liquid chlorine treatment will eliminate this trouble, besides saving cost of material, and eliminating the extra labor force employed to apply the hypochlorite. The hypochlorite treatment was used intermittently at first, but is now being used continuously.

Cracks in Concrete Roads

In view of the importance of the fact that cracking of concrete roads is generally considered to be one of the most serious objections to them and the most difficult to avoid, the Municipal Journal expresses the opinion that sufficient attention has not been given by engineers and road builders generally to the report of the committee of the National Conference on Concrete Road Building concerning the contraction and expansion of concrete roads, based largely on investigations made by the U. S. Bureau of Standards.

One of the most important features of this report, as well as that which undoubtedly seemed the most novel to many, was the statement and apparent proof that not only does concrete expand with the absorption of moisture and contract as it dries out, but that this effort of temperature changes and may be sufficient to cause a stress in the concrete opposite to that which would be caused by a normal temperature change. Moreover, this effect of moisture absorption and drying out apparently continues throughout the life of the concrete. It would seem to follow, therefore, states the committee, "that the condition that would provide for a decrease in moisture content when the temperature increases and an increase in the moisture content when the temperature decreases, would be an ideal one."

The experiments made also indicate that variation in the quality of the concrete will cause a variation in the tendency to expand and contract with change in moisture content, as dense mixtures absorb moisture less rapidly than porous ones. Consequently, if there are two qualities of concrete in a road existing either as a top and bottom layer or in two masses (such as two successive batches of slightly different mixture) occurring side by side, the more porous of the two would have a tendency to expand more than the other and consequently move a greater distance, resulting in tensile stresses and possibly in shearing between the two masses of concrete. If the base of a two-course pavement is more porous than the top, the tendency would be for the former to expand and contract more than the latter and thus cause a separation of the two.

The above is the strongest possible argument for securing absolute uniformity in both proportioning and mixing, in order that not only all of the contents of any one batch but also all the batches in a given pavement, shall be as nearly as possible absolutely uniform in composition and homogeneous in structure. How far this is from realization in too many concrete roads is known by many engineers who have given the subject attention.

Another point suggested by this effect of moisture on concrete pavements is the desirability of draining on subgrade. In a number of cases concrete paving has been adopted for certain stretches of road, because they were too soft and moist for macadam construction, and the assumption is made that dampness under a concrete pavement does not injure it in any way. If the soil and the pavement are kept uniformly damp all the time, this would probably be true, assuming that the dampness has no other effect. The committee, however, calls attention to the probable effects of frost in the subgrade, due to the expansion of the soil when the moisture in it freezes. If the subgrade is dry, there will, of course, be no such freezing and consequent expansion. On the other hand, if the soil be wet and the temperature falls sufficiently low, there will be freezing and expansion. If this freezing and expansion are uniform across the entire width of the road, and if the frost likewise leapes the ground uniformly throughout the width, thus allowing the pavement to settle uniformly, there may be no objectionable results. The committee remarked, however, that it is reported that cracks in concrete usually appear during a thaw rather than during a frost, and that this may be explained by the fact that the heat may be transmitted more rapidly through the shoulders than through the centre of the road, thus causing the sides of the paving to settle more rapidly than the centre. On the other hand, it seems probable that the action of frost will occur sooner and be more considerable along the edges than in the centre. The result of this double action would be the raising of the edges of the road during freezing, thus causing a longitudinal medial crack on the underside of the pavement which would not show, followed by the opening of the pavement above this crack on its top surface as, during the subsequent thaw, the shoulders settle more rapidly than the centre. This explanation would account for the frequent occurrence of long cracks down through the centre of concrete pavements and also of many other kinds of pavements which are laid on concrete foundations. If this explanation is correct, the drainage of the sub-grade of concrete and concrete-foundation roads would appear as essential as in the case of the various kinds of macadams.

The committee, in view of their investigations, advises that the best mixture is that which is most dense, that the concrete should be mixed and placed in such a way as to produce a product of uniform quality; that the sub-base should always be thoroughly wet before the concrete is placed to prevent rapid drying out, and that the concerte should be kept moist until it is strong enough to resist the stresses which will be caused by contraction due to drying out.

As to the effect of length of slab upon transverse cracks, the committee gives 25 feet as the maximum length for slabs in localities where there is little rainfall, while in localities where the rainfall is intermittent and the ground water rises in cool seasons and lowers in warm seasons the length may vary from 30 feet to a continuous slab. The length of slab should vary with the quality of the concrete, since the denser concrete will absorb less moisture and consequently have less tendency to move. The length should also vary with the condition of the sub-grade. If smooth on a steep grade, the slab should be made shorter to avoid the tendency to slide down hill. Where there is any decided change along the length of the road in conditions of smoothness of sub-grade, a joint should be placed at the point where this change occurs.

The thickness of the slab also may be considered in determining the length, since the greater the thickness the greater the strength of a horizontal foot of cross-section, and this increase is greater than the increase in resistance to motion due to friction between the concrete and the sub-grade.

Experiments indicate that there is greater movement in a concrete pavement or concrete base covered with a bituminous carpet than in that uncovered, the reason for which probably is that a dark surface absorbs more sun heat and also that the bituminous coating causes the concrete to retain for a longer period any moisture which gets beneath and into it.

The committee does not believe that the width of slab affects transverse cracking.

It favors a dished subgrade under all climatic conditions as being best able to resist tendencies to longitudinal cracks.

As to reinforcements, it recommends this when foundations are uncertain; in regions where there is little rainfall and long or wide slabs are desired, or where there is insufficient water for curing; when it is necessary to have a thin slab; when a decided change in grades occurs; when the movement of the concrete is restrained, as at street intersections or on curves, if joints cannot be placed properly; when the width of the slab is greater than 25 feet; or when it is necessary to crown the sub-grade and the slab cannot be made thicker at the crown than at the sides. Fabricated steel should be used in that form which will give the greatest distribution. Where the reinforcement should be placed depends upon what conditions seem to demand it, it being placed nearer to that surface which will be placed under tension by such conditions. When used to resist stresses due to temperature and moisture changes, it should be placed near the bottom. Ordinarily, it is unnecessary to provide for temperature stresses, which are insignificant compared to those of moisture.

Where a road is constructed without joints, with the idea that nature will provide the joints where most needed, the concrete will weaken for some distance on each side of the place where the crack occurs, which may result in a partial disintegration of the concrete. There is, of course, the additional objection that the cracks will be irregular in line and more objectionable in appearance than with a straight joint. The thinner a joint the better, since stresses caused by expansion are readily absorbed by the concrete, and the less actual expansion permitted the less will be the movement from contraction and consequently the tensile stresses which produce cracking.

Uniformity in the sub-grade is very important, this applying to both the compactness and the smoothness, since unequal compactness will allow unequal settlement and unequal smoothness will allow unequal motion in different parts of the pavement, both of which will produce stresses unequally distributed and therefore more likely to produce cracks.

Among individual suggestions made in the discussion were the following: R. J. Wig, of the Bureau of Standards, chairman of the committee, believes that joints should be constructed as contraction joints, providing little or no room for expansion.

W. A. McIntyre emphasized the necessity of making the joint perpendicular to the surface of the pavement, because of the tendency otherwise for one slab to lift up onto the other when expansion occurs.

The Committee on Joints reported that "expansion joints should be kept filled to the level of the pavement surface so that there will not result an impact when wheels cross the joint. If the joint is not kept filled, grit will accumulate and in time the joint will be filled with non-elastic material. Even a joint which has been kept filled will in time become jammed with grit."

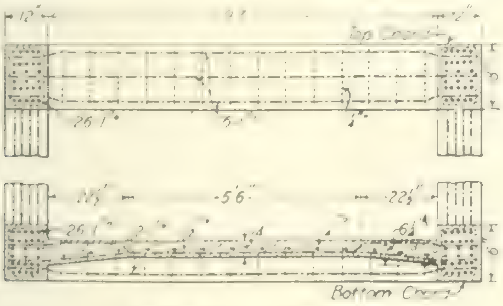
This point was also referred to by H. D. Kerr, who said that when the elastic material has spueezed out in hot weather or been worn away, the joints should be cleaned out and refilled; one reason for this being to prevent the penetration of water through the joint to the sub-grade.

Large Trussed Concrete Bridge

REINFORCED concrete bow-string bridge of 162-ft. span, designed for a live load of 80 lb. per square foot and a wind pressure of 30 lb. per square foot, has been built at La Louviede, Belgium, and is described in a recent issue ofThe Engineering Record. The clear width between trusses is 9 ft. 3 ins., the structure being uesd solely by pedestrians. It is believed to be the longest of its kind. The design is shown in the accompanyng drawing . The top chord is a parabola and has a uniform cross-section of 12 x 18 ins. The bottom chord is suspended by 12 x 16-in. verticals and serves as a tension member to resist the horizontal component of the end reactions. Nine 16 x 18-in. struts located at panel points provide overhead bracing to stiffen the compression chords.

Floor

The floor is figured as a slab spanning the distance between trusses. It is 4 ins. thick at the centre, the thickness at points of support being increased to 6¼ ins. in order to take care of the increase in vertical shear. Because of the heavy reaction of 65 tons, the bearings at the ends of the trusses have been designed in the same way as for a steel bridge. The upper parts of the roller bearings are fastened to the truss by three horizontal bolts, inclosed in pipes so that they can be easily removed.



Cross-section of trussed bridge.

The permissible unit stresses in steel and concrete were selected in accordance with the rules for Belgian highway bridges, and amounted to 710 lbs. per square inch for concrete in compression and 17,070 lbs. per square inch for steel.

Camber to Take Care of Deflections

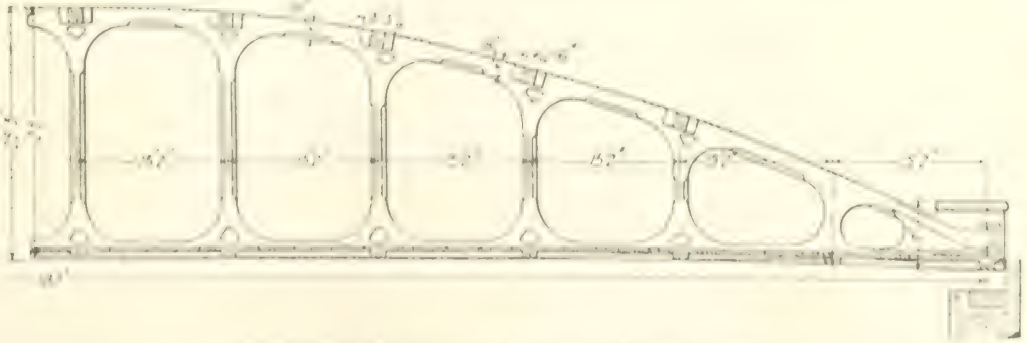
A 3-in. camber was provided to take care of deflections. The maximum permissible deflection for a full live load of 80 lbs. per square foot was 2.2 ins., but under the test load the actual deflection at the centre was only 0.47 in. In accordance with the wish of the designer impact tests were also made. Twenty-four workmen marched over the bridge in both directions and afterward assembled at the centre of the bridge and jumped five to six times. Under the first test a wave action was created which at no point exceeded 0.12; under the jumping-test this wave action increased to 0.20 in..

The bridge was designed by Professor Vierendeel, of Bruges, and the work was executed by Grondel Brothers, of Ghent, Belgium.

In an article on the Transcontinental Railway Company's air-lift plant at the new Quebec Bridge in the Contract Record of November 11, it was inadvertently stated that the air lift delivered over 4,500 Imperial gallons per hour into a tank having a capacity of 70,000 gallons. The statement should have been **5,500 Imperial gallons** per hour.

The Oklahoma Geological Survey has just issued a new State map. The existing maps were found to be lacking, especially as to the proper location of railroads and also of some of the smaller towns. The general procedure in making the map was as follows: The network of 30 miles in latitude and longitude was constructed as a base. On this was imposed the areas covered by the U. S. Geological Survey. The balance of the State was filled in according to the U. S. Post Route Maps of 1914. Requests for information were also made to the different county surveyors. Finally, by courtesy of the different railroad companies the surveys of sections through which they passed was added. The map is not put out as being entirely correct, as limitation of funds prevented an extensive survey.

Modern street paving is as yet practically unknown throughout Japan. The usual Japanese street has no footway, and no attempts have been made to provide separate roadways for pedestrians outside the business districts of the more important cities. These streets have no artificial paving, they are usually macadamized in as cheap a way as possible, and are in bad condition at all times of the year in the congested traffic districts. In the city of Tokyo, where there is a population of some 2,000,000, there is only one steam roller employed on these pavings, and that is usually out of order. In Yokohama a few of the business streets have cement footways, but none of the streets are paved. Yokohama has a population of about 400,000, and a street mileage about equal to that of any city of like population.



Half elevation of bridge showing arrangement of truss members

Concrete Roads—Their Design, Specifications and Present Status[*]

By A. A. Young

IN the last five or six years engineers and corporations have given increasing attention and importance to the use of concrete (without a surface coating) as a paving material. Within that period concrete has practically become a requisite as a sub-base for all surfaced pavements. The logical development was that someone would experiment with concrete alone as a pavement, so that to-day there are 2,000 miles of concrete road in the United States and 40 miles in Canada. In the following paper the writer will take up, first, the development of the design for concrete roads; second, the specification for the same; third, the present status.

DESIGN

In bringing forward concrete (without a covering) as a pavement, engineers and corporations were given confidence by the fact that Bellefontaine, Ohio, has a concrete pavement which at that time (six years ago) had been down fourteen years. It was laid as a sidewalk, in slabs or small blocks, in two courses of 5-inch base and 2-inch top surface. It shows no cracking and very little evidence of wear and abrasion even at the present time. Engineers appeared to stop at this investigation and instead of following out the design used by the Bellefontaine people, they went back to their experience with concrete base for a surfaced road. The result was, that in most localities, long stretches of concrete road were laid on a more or less compact base in widths from 12 to 24 feet and 6 or 7 inches thick, in which the mixture was low in cement, and drainage of the subgrade, evenness of the surface of the concrete and expansion and contraction received little or no attention. In reading up reports on concrete roads, the writer found that nearly every locality had a piece of this type of road constructed, even when improvements with a slight increase in cost were going on in other districts. That is, the engineers in charge, or possibly the corporations supplying the funds, did not benefit by the experience of other localities, but preferred to experiment for themselves. The result is that now we have a large number of poor pieces of concrete road which are used to good purpose as detrimental to the present standing of this type of pavement. Very soon there appeared in these stretches numerous longitudinal and traverse cracks and excessive wear under traffic. These two faults—cracking and abrasion —have ever since been the object of all experiment and study in this type of road building. The main points of design which affect these two features are: expansion and contraction; thickness and width; grade; crown; mixture.

Designs and specifications vary greatly according to the requirements and local conditions, therefore no attempt can be made to give a definite design. All that can be done is to give an outline of the different features which should be considered in working out the same.

Expansion and Contraction.—The chief conditions affecting expansion and contraction are: 1, changes in temperature; 2, changes in the moisture content; 3, variations in the condition and character of the sub-base.

1. The theoretical change in the length of concrete due to temperature changes is commonly taken as 0,000006 per degree per unit of length. Taking a normal range of temperature of 140 degrees in our northern climate, the movement which would occur, due to this influence alone, would be 0.00084 per unit of length.

2. Experiments with concrete subjected to moisture and drying show: (1) that concrete expands with moisture and contracts on drying out; (2) that the rate of contraction is faster than the rate of expansion, being probably about twice as fast; (3) the change in length in contraction after three months is about 0.0005 per unit of length in concrete of ordinary consistency and mixture.

3. The character and condition of the sub-base contraction and expansion: 1, by varying the amount of moisture under the concrete; 2, friction or resistance offered by the sub-grade to the concrete slab. The rougher the sub-grade, the greater is this resistance, with a corresponding increase in the stresses. Although these are compressive in expansion, in contraction they are tensile and need consideration.

If a concrete road is built with the idea that nature will provide cracks for contraction and expansion, the pavement will crack, but only after causing a weakening of the concrete for some distance on each side of the opening, as is evidenced by short forked cracks running off the main crack. These may result in a partial disintegration of the road. If contraction joints are provided, they relieve these heavy stresses and lessen to a great extent the weakening of the concrete.

When a stretch of concrete is setting up or taking its initial set, it contracts and shrinks. The tensile strength of the concrete in this state is very small and lines of weakness are formed which may not show at first, but when the subsequent contraction due to moisture content and temperature changes takes place, these lines of weakness develop into cracks. For this reason the length of the slab is made small, in fact, the shorter the slab the stronger it will be to resist tension. As the moisture and temperature of the concrete and the conditions of the subgrade at the time of placing all affect the contraction at that time, it has been found difficult to calculate the proper length of slab. This distance has been derived by experiment and 16 to 30 feet is the accepted length, 16 feet being absolutely safe and 25 feet common practice. Roads have been built successfully with much longer slabs, even up to 50 feet, but the conditions there must undoubtedly have been favorable. As the conditions are changeable, and more or less uncontrollable, the smaller lengths are safer. This range of lengths can be increased by the use of reinforcement where other conditions warrant the increase in length. The type of reinforcing used is usually triangular wire mesh.

Having decided on the position of the joint, the question arises as to the maintenance of this joint. This includes the amount and type of filler and the protection of the joint. From the paragraphs on moisture content and temperature changes, the maximum expansion possible under the most favorable conditions is seen to be about 0.001 per unit length. For a slab 25 feet long this works out to ⅜ inch. Now the shrinkage is usually about ⅛ inch when the concrete sets, so a space of ¼ inch will cover the greatest possible expansion. This is the usual practice, with a tendency to the smaller space of ⅛ inch, because we practically never have the combination of circumstances which gives this maximum expansion.

The following are the usual methods of making the joint: (1) a tar felt paper joint ⅛ to ¼ inch thick with no protection; (2) a tar felt paper joint ⅛ to ¼ inch thick with the edges of the concrete rounded with a sidewalk tool; (3) a tar felt paper joint ⅛ to ¼ in. thick with plates of soft steel ¼ inch by 3 inches on each side, which are flush with the concrete and wear with it; (4) the same as (3) with tar filling; (5) a wider joint with wooden creosote blocks between, which are placed flush with the concrete and which broom down as the concrete wears.

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[*] Paper read before the Manitoba Branch of the Canadian Society of Civil Engineers.

Of all these (3), that of the soft steel protection with the felt paper as a filler, is the one most commonly used, is fairly reasonable in price and easily constructed.

Thickness and Width

A careful investigation of the thickness of pavement used in the various districts shows that they range from 6 to 8 inches, with a tendency at the present time towards the greater thickness at the centre of the road. This is significant when we consider that in road-making in the older countries of Europe they do not hesitate to put down 8, 10, and even 12 inches, length of life being considered an essential feature in the calculation of the cost of the pavement. Let us assume, therefore, that 7 or 8 inches at the centre is a thickness which will not place the cost over that usually spent on a permanent road. At the present time three general ideas of design of width relative to thickness prevail.

1. To lay the pavement in small sections after the design of sidewalks, about 7 inches thick. This is not generally used, but a pavement of this type in Bellefontaine, Ohio, has given over 20 years' service with a very small maintenance cost and no cracking.

2. To lay the pavement in slabs the width of the road required and the length permitted by expansion and contraction, thickness being from 6 to 8 inches. This is the usual design and up to the present has met with varying success. There is a tendency for a central crack to develop in the wider pavements, the number of slabs having these cracks increasing a little, year after year. The cracking has been reduced and in some cases eliminated by using mesh reinforcement. Of course, there are a few exceptional cases where this design without reinforcement has been used and no cracks have developed.

3. To lay the pavement in slabs not greater than 12 to 16 feet in width, depending on the load, a longitudinal joint being placed in the pavement where widths greater than these are required. The thickness used is 6 to 8 inches. This is a new design and only one or two pieces of it have been laid within the last two years, consequently its success cannot yet be ascertained.

These various designs seemed to be based on different assumptions as to the bearing of the concrete on the subgrade and their success or failure can usually be traced to the condition of the subgrade or the provision made for contraction.

Let us consider design No. 1, in which the sidewalk slab is used. Its success is probably due to the fact that it is designed to meet the worst conditions, that of settlement of [illegible] at the outside edges of the pavement [illegible] of poor drainage. Where the subgrade settles at the edges under a slab the full width of the road, severe tensile stresses are set up in the central portion and extreme thicknesses of concrete are required to carry this cantilever action, as shown in tables No. 1 and No. 2 for 1:1½:3 concrete.

Table No. 1

Modulus of Rupture in Tension 400 lbs. per sq. in. F. S. = 2.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6 tons	6.7	8.4	10.2	12.9	18.8
8 tons	7.6	9.2	11.3	14.2	20.2

The figures are thicknesses in inches of plain concrete to carry cantilever loads on an arm of half the width of pavement. One inch should be added for wear

Table No. 2

C = 750 lbs. per sq. in. S = 16,000 lbs. per sq. in. P = 0.0061.
Load = 8 tons.

	10 ft. wide	12 ft. [illegible]	16 ft. [illegible]
Thickness of concrete in inches	6.2	8.4	[illegible]
Sect. area steel, sq. in. per lin. ft. road.	0.15	0.31	[illegible]
Lbs. steel per lin. ft. road	10.3	16.7	[illegible]
Cost per sq. yd. at 4c. per lb.	37.4c.	[illegible]	65.0c.
Equiv. thickness concrete at 25c. per sq. yd. thickness	1.5	2.0	[illegible]
Total equivalent thickness	7.7	10.4	13.5

This table gives thicknesses of concrete and lbs. of steel to carry cantilever loads on an arm of half the width of pavement, reduced to equivalent thicknesses in inches of plain concrete. Steel is placed in the centre two-thirds of the width. One inch to be added for wear.

From table No. 1 it is seen that if we assume settlement, we must make the slabs in sidewalk sizes in order to have an economical thickness of concrete. This is not generally used on account of the possible roughness or jarring due to so many joints, and because settlement is a thing which can be obviated by careful construction methods at a very slight increase in cost over careless methods. A study of tables No. 1 and 2 will emphasize the absolute necessity of care in grading, as they show the thicknesses required at the centre in wider pavements if settlement is allowed and these thicknesses both in plain and in reinforced concrete are prohibitive in price.

Design No. 2, in which the slab is the entire width of the pavement. Grading is a part of construction and can be governed, but the effects of moisture and frost which may occur alternately four or five times a year, are difficult to provide against. It is usual to put down drains on each side of the pavement and endeavor to keep the moisture level at least two feet below the concrete. In soils which are self-draining and pervious there is very little capillary moisture and then the effect of moisture and frost may be neglected. In soils which are difficult to drain moisture and frost under the edges of the pavement tend to raise it and give a simple beam action. Tables Nos. 3 and 4 give the thickness at the centre of a pavement of plain concrete (1:1½:3), and equivalent thicknesses of reinforced concrete for various widths to carry this beam action.

Table No. 3

Modulus of Rupture in Tension=400 lbs. per sq. in. F. S.=2.

Load	8 ft. wide	10 ft. wide	12 ft. wide	16 ft. wide	20 ft. wide	24 ft. wide
6 tons	4.0	5.6	6.5	8.1	11.3	13.0
8 tons	4.5	6.1	7.1	9.5	12.2	15.8

This table gives the thicknesses required to carry a load on a simple beam supported at the outside edges of the pavement, over a span of two-thirds the width. One inch should be added to these figures for wear.

Table No. 4

C = 750 lbs. per sq. in. S = 16,000 lbs. per sq. in. P = 0.0061.
Load = 8 tons.

	10 ft. wide	12 ft. [illegible]	16 ft. [illegible]	[illegible]
[illegible]	[illegible]	5.5	6.0	[illegible]
[illegible] sq. in. per lin. ft [illegible]	0.25	[illegible]	[illegible]	0.50
[illegible] lin. ft. of road	5.7	8.5	[illegible]	32.1
Cost per sq. yd. [illegible]	[illegible]	25.4c	31.0c	[illegible]
[illegible] concrete at 25c. [illegible]	[illegible]	1.0	1.2	[illegible]
[illegible]	5.1	6.5	[illegible]	[illegible]

This table gives the thicknesses of concrete and lbs. of steel to carry the load on a simple beam supported at the edges of the pavement, reduced to equivalent thicknesses of concrete in inches. The steel is placed in the centre two thirds of the width. One inch to be added for wear.

The varying success of design No. 2 is due to the use of practically the same thickness of concrete for all widths of road and upon all soils. Now, in cases where no cracking occurred, the subgrade, besides being well rolled and prepared, was well drained, while in the cases where the longitudinal cracking occurred inside the first year, the most of it is probably due to settlement and a little to frost and moisture, and the additional cracks from year to year are undoubtedly due to moisture and frost. From tables Nos. 3 and 4 it is seen that if the drainage is uncertain, 12 to 16 feet is the widest slab that can be made of the economical thickness, 8 inches being too small a thickness for pavements wider than 16 feet.

This leads to design No. 3, where the longitudinal joint is introduced. This longitudinal joint divides the pavement into widths which permit an economical thickness and retain the required strength against beam action. It is a recent idea and has been little used so far, but it is inexpensive—being equivalent to not more than one-half inch thickness per sq. yard of concrete. The only drawback to roads of this type is that they are difficult to construct satisfactorily, as the protection plates used for the transverse points are not sufficiently solid for longitudinal joints. However, with comparatively little improvement, this design will be worthy of consideration as it permits movements of the edges of the pavement without cracking. Even in the small widths this method results in the saving of an inch or so in thickness of concrete.

From this discussion and the above tables, it is evident that the greatest possible stress is at the centre of the slab and, therefore, the greatest thickness is necessary at that point. The stress will be less towards the edge and the thickness may be reduced there.

The wear of traffic on small pavement is more at the centre, while on the wider pavements it is more evenly distributed. Generally speaking the wear at the outside edge of the pavement is negligible. For these two reasons, common practice is to make the outside thickness of concrete about 5 or 6 inches.

Summing up this discussion we may say that thickness and width are made such as to be economical and to eliminate cracking. The two main causes of cracking are settlement of thhe subgrade at the outside edges and action of moisture on the subgrade at the edges. Settlement of the subgrade is the result of poor workmanship and is preventable; action of moisture on the subgrade is due to natural causes and in a great many soils is uncontrollable. Tables 1 and 2 demonstrate that the subgrade must be properly compacted as it is not economical to design the concrete to cover this defect. The drainage possibilities then govern the width and thickness. Tables 3 and 4 show that only in the case of self draining soils should the pavement be wider than 16 feet, longitudinal joints being advisable for the greater widths. The prevailing idea of the design should be to reduce the tensile stresses due to contraction and beam action and to increase the tensile strength.

Gradee.—Concrete may be used on any grades on which other hard surfaced pavements can be used. On grades steeper than 3 or 4 per cent., shallow corrugations will be found of assistance and they are a necessity with grades of 5 per cent. and over.

Crown.—A study of the crowns of the surface used on concrete roads of America, shows that they range from 1/48th of the width to 1/160th of the width, but the great majority are between 1/70th and 1/100th of the width. A common practice is 1/96th. Where curb and gutter are used, in order to prevent an undue proportion of the pavement being covered with water, a peaked crown is used. That is, ⅞th of the rise is at ¼ the distance from the centre to the curb and ⅝th at half the distance.

From the crown of the surface and the thickness required for the width of the slab, the shape of the subgrade may be established. The subgrade should be made to conform with the design of the slab, that is, the crown of the subgrade should not be established first and the thickness then made to be the amount between it and the crown of the concrete.

Mixture.—So far cracking has been the topic of discussion, the question of wear and abrasion is also an important consideration in design. In the early pavements where the materials and mixture received insufficient attention, a great deal of ravelling occurred. This was not really wear, but rather the breaking up of the bond of the materials by the traffic. Improvements have been made from time to time until now the wear of concrete is considered merely a matter of inspection and workmanship.

About a year ago a very interesting test of various mixtures was made in Chicago. Narrow slabs of different mixtures were made up and placed in a circle, from the centre of which two arms were rotated. On each of these arms was a heavy wheel weighing 1,400 lbs. with three-inch iron tires, and at intervals on the circumference of the wheels, shoes were placed alongside, which gave blows similar to those of horse hoofs. These wheels were so arranged as to move 27 inches along the radius or arm as they rotated. In this way each slab was subjected to the same wear, which was similar to that caused by horses hoofs and heavy wagons. Table No. 5 shows the results after 20,700 rotations of the machine.

Table No. 5

No.	Mixture	Wear (inches)	Remarks
1.	1:1½ :3 screened gravel ¼"-1½"	0.19	Uniform wear, rough
2.	1:1½ :3 granite (4 parts 1"-1½," 3 parts ¼"-1"	0.11	Uniform wear, perfect condition
3.	1:2½ :5 screened gravel ¼"-1½"	1.38	Poor condition
4.	1:2 :4 screened gravel ¼"-1½"	1.77	Poor condition
5.	1:2 :3 screened gravel ¼"-1½"	0.24	Uniform wear, rough
6.	Top course 1 cement: 2 clean sand	0.26	Uniform wear, smooth
7.	Top course 1 cement: 2 mixture (1 part of ¼" granite to 2 parts of ¼"-¾" granite	0.18	Fairly uniform
8.	1:1½ :3 crushed limestone ¼"-1½"	0.13	Uniform wear, smooth
9.	1:2 :4 crushed limestone	0.44	Uneven, rough
10.	1:2 :4 crushed limestone (4 parts 1"-1½", 3 parts ¼"-1")	0.16	Uneven, rough

zFrom this table, comparison of different mixtures of the same materials and comparisons of the same mixtures of different materials can be made. The main conclusions are:

1. The mixtures with granite show less wear than that of the same mixture of limestone or screened gravel or that of the sand top course.

2. From test pieces 1, 3, 4 and 5, test pieces 2 and 10 and 8 and 9, it is demonstrated that under the most severe traffic conditions the 1:1½:3 mixture gives a satisfactory wearing surface and that the mixtures containing less cement will not withstand the impact and abrasion of traffic in a degree at all comparable with the richer mixtures.

3. From test pieces 2 and 7, it is seen that the mixtures with the higher percentage large sized aggregate give a better wearing surface.

4. From test pieces 1 and 5, it is evident that an increase in the amount of fine aggregate slightly decreases the resistance to wear, and test 6 shows that a top course of sand and cement decreases the resistance to wear still more, although the difference in either case is not great enough to warrant placing the mixture out of consideration.

5. The tests also show that in the case of the keener mixtures it is much more difficult, even in the laboratory sections, to obtain an even surface that would resist the pounding of the traffic.

6. The order of resistance shown in the test was as follows:—1, 1:1½:3 granite; 2, 1:1½:3 crushed limestone; 3, 1:1½:3 screened gravel; 4, 1:2:3 screened gravel; 5, ½ sand top course.

7. The remaining mixtures should not be considered where the traffic is at all heavy.

This test proves conclusively that rich mixtures are necessary to secure a bonding of the concrete which will prevent the large aggregate of the mixture being torn out by the traffic.

(Concluded next issue)

Personal Mention

Mr. A. W. E. Fawkes, waterworks engineer for the city of Calgary, has resigned and opened an office in the Burns Building, Calgary, to carry on a general engineering practice.

Mr. H. G. Hawley, associate engineer on Federal drainage work in Alabama, has returned to become associate engineer of the Canadian Pacific Railroad, with office at Minneapolis.

Mr. J. Vipond Davies, vice-president of Jacobs & Davies, Inc., consulting engineers, New York City, was awarded by the Institution of Civil Engineers, London, Eng., the Telford gold medal of that institution for his paper on the "Extension of the Hudson River Tunnels of the Hudson & Manhattan Railroad." The Telford gold medal is the premier medal of the institution and dates back to 1835, funds for the purpose having been bequeathed by the celebrated engineer, Thomas Telford, the first president of the institution, 1820 to 1835.

Mr. William B. Bryan, chief engineer of the Metropolitan Water Board of London, died recently. He was born in 1848 and began an official career in 1870. In 1882 he was appointed chief engineer of the East London Waterworks Company, remaining as water engineer to the Borough of Blackburn until the completion of new waterworks. In 1904 he took up the appointment of chief engineer to the Metropolitan Water Board. Mr. Bryan was a member of the Franklin Institute, of Philadelphia, and of the New England Waterworks Association, besides many English technical societies.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

At St. Felicien, Que., a stone church erected at a cost of Jos. P. Ouellet, 28 Ste. Famille Street, Quebec.

At Hamilton a six-storey departmental store is to be erected by Mr. John Lennox. Plans have been prepared.

The ratepayers of Ottawa will vote January 1 on a by-law to raise $250,000 for the construction of an intercepting sewer.

The city of Berlin, Ont., will submit a by-law to raise $14,000 for the installation of an incinerator. The contract will go to the Ideal Incinerator Company, Toronto.

Included in the budget estimates of the Montreal Council is $50,000 for an improved lighting system, postponed from this year, and also $92,000 for a new police signal system.

The West Lake Brick & Products Company, Limited, Wellington, Ont., has been incorporated with a capital of $250,000. Mr. H. A. Rose, Sr., of Welland, Ont., is identified with the enterpirse.

As the result of a conference between the Montreal Harbour Commissioners and the Minister of Marine, the proposed addition to the west end of No. 1 elevator has been postponed until the spring.

At a meeting of the Royal Canadian Institute held at the University of Toronto on Saturday, November 14th, Prof. Angus gave an address entitled "The Proposed Waterworks System for Toronto."

The Board of Education at Toronto is to spend $100,000 upon the erection of a new building to house its various departments. It is to be erected on the north side of the present Central Technical High School, on College street.

Professor T. L. Walker, of the University of Toronto, gave an interesting address before the members of the Engineers' Club of Toronto on Friday, November 20. He took for his subject his experiences in Germany after the declaration of war.

Messrs. Ross & Macdonald, Montreal, are now drawing plans for a proposed large office and loft building at Mayor and St. Alexander Streets, Montreal, for Mr. H. B. Mussen. The site cost $210,000. The work will not commence until the war is over.

Exterior work is proceeding on the new Loyola College which is being erected at Notre Dame de Grace at a cost of $400,000. The architects are Messrs. Peden & Mclaren and the general contractors are Mesrs. Anglins, Limited, both Montreal firms.

Mr. Richard S. Buck, recently chief engineer of the Dominion Bridge Company, Canada, and previously with the engineering firm of Sanderson & Porter, New York, has been appointed engineer of maintenance of way of the New York (N. Y.) Railways.

Steel work is in progress in the new soap factory which has been erected at Hamilton by the Proctor-Gamble Company. The building is to be three storeys high, of reinforced concrete and brick construction.

Mr. Chas. D. Campbell, Town Engineer of Galt, has resigned his position as Town Engineer of Preston owing to the increase of duties in the larger municipality. It is stated that the vacancy at Preston will be filled by the appointment of a resident engineer.

The Committee of Management of the International Engineering Congress have issued a pamphlet denying the report recently circulated to the effect that this congress was to be abandoned. The congress will be held in San Francisco, as scheduled, from September 20th to 25th, 1915.

Operations on the apartment house which is being erected for a syndicate on Bay Street, Hamilton, according to plans prepared by Messrs. Stewart & Witton, have reached the roofing stage. The building, which is to cost $100,000 is to be five-storeys high, of reinforced concrete construction.

Toronto reports that the directors of the Humber Beach Hotel, which was destroyed recently by fire, have decided to erect another building on the old site. The new hotel will be a fireproof, brick structure. The work of razing the old building will commence at once. It is hoped to have the new hotel ready by the spring.

Builders' Exchanges and similar organizations have been asked to support a deputation to the Premier in favour of the establishment and maintenance of a central Federal labour bureau and free local bureaux. The question has been before the Government on several occasions and the Cabinet is pledged to introduce a Bill next session.

Operations have been temporarily suspended on the new R. C. church which is being erected at Ville Emard (Montreal) at a cost of $150,000. We are informed that sub-contracts will be awarded when operations are resumed, which will probably be in early spring. The architect is Mr. A. Bergeron, Longue Pointe, and the general contractor is Mr. H. Tessier, Montreal.

Mr. Duncan McCormick, K.C., of Montreal, has been appointed chairman of the permanent board of arbitration between the General Contractors' Association of Montreal and the United Brotherhood of Carpenters and Joiners. This is in connection with the agreement as to wages made between the contractors and several trade unions, acting as the first, the appointment being by the Minister of Labor.

There is a movement under way to construct a Peace Memorial Highway stretching across the province of Ontario from Windsor to Montreal. Details have not yet been worked out but the idea of the promoters is to [illegible] co-operation of the municipal bodies and organized motorists of the province. The mileage, outside of urban districts, is estimated at 375 miles and the cost of the whole undertaking is placed at $6,000,000. Mr. W. A. McLean, Provincial Engineer of Highways, has interested himself in the project.

Mr. J. G. Sing, District Engineer at Toronto for the Department of Public Works, has resigned that office and will go into practice as a consulting engineer, acting in an advisory capacity to the Toronto Harbor Commission. It is stated that Mr. M. Wilson, who has been assistant to Mr. Sing, will be promoted District Engineer. Mr. C. H. Mathewson, the present engineer on the government work for the Harbor Board, will temporarily assume charge of the extensive harbor improvements in Toronto, which involve an outlay of $7,000,000, the government's share of the work.

WESTERN CANADA

In the Westmount subdivision of Edmonton a new brick building has been erected for the School Commissioners by the Edinger Construction Company at a cost of $150,000.

Fort George, B.C., was visited last week by a fire which caused a loss of some $150,000. The fire originated from an explosion. The entire east side of Central Avenue was destroyed.

Mr. M. Janse, the Calgary contractor, was in Vancouver recently studying the plans of the grain elevator there. Mr. Janse's firm is building the elevator at Calgary, which is now more than half completed.

A western incorporation worthy of note is that of Canada Grain Securities, Limited, of Winnipeg, a new concern capitalized at $200,000. The company will conduct a general grain business and erect grain elevators and mills.

Arrangements are being made by the Winnipeg Board of Control for the construction of sewers on a number of streets. The total estimated cost of the work planned is $500,000. It is proposed to carry out the work by day labor. Mr. W. P. Brereton is City Engineer of Winnipeg.

Exterior work is advancing rapidly on the stores and offices which are being erected at Edmonton for Messrs. Adams Bros. by the Frid Lewis Company. The building is to be four storeys high, of stone and brick construction. The estimated cost is $150,000. Messrs. Barnes & Gibbs, of Edmonton, are the architects.

At Edmonton, a store and office building is being erected for Mr. J. Kelly by Read, MacDonald & Brewster, general contractors. The building, which is to cost $125,000, is to be five storeys high, of brick and reinforced concrete construction. Operations are now well under way. The architects are Messrs. Van Siclen & Macomber, of Edmonton.

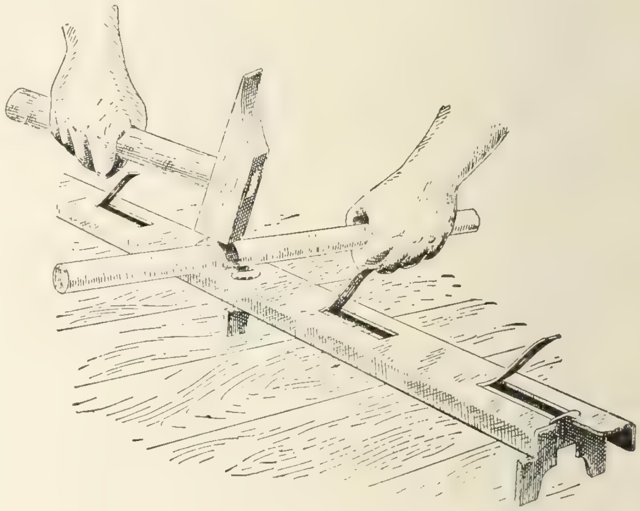
At South Edmonton, Alta., operations have been renewed on the new buildings for the University of Alberta. The general contractors are the Geo. A. Fuller Company, Limited, and the total cost of the undertaking is placed at $450,000. The building now under construction will be four-storeys high, 60 x 375 ft. in dimensions, of stone and brick construction.

Mr. J. W. Stewart, president of the Pacific Great Eastern Railway, announces that construction is proceeding with undiminished vigor all along the route of the new line from the end of steel near Pemberton to Fort George. He said that a force of nearly 7,000 men is engaged in the task of projecting a new line into the interior. Incidentally, he mentioned that a sum aggregating between $1,250,000 and $1,500,000 was being spent each month in the work of construction.

According to advices received by the Hon. Thos. Taylor, construction work is now well advanced on the bridge for the Kettle Valley Railway, which will link the new Hope Mountain route with the C. P. R., on the north side of the Fraser River, near Hope. The first of the bents has been completed, and structural operations are proceeding briskly. The Kettle Valley line has been linked up between Midway and Penticton, and construction work is well advanced towards Princeton, where the railway will join the V. V. & E., and use a joint section to Otter Summit, where connection is made with the Nicola Valley branch of the C. P. R. Grading has been almost completed on the Hope-Coquohalla Summit section of the Hope Mountain route, and it is anticipated that the new line will be ready for traffic to the coast next summer.

The "Efficiency" Spacing Bar

A patented spacing bar for holding reinforcement in place, in concrete slabs, has just been put on the market by the Electric Welding Company of Pittsburgh, who are represented in Toronto by the Railway-Contractors Supply Company, Room 504, Standard Bank Building. The accompanying sketch gives a view of the bar and the method of its uses. It is known as the "Efficiency Spacing Bar." The bar consists of a ¾-inch channel pierced at the required centres for floor rods. The metal strip from openings is bent up at an angle sufficient to admit the floor rod. At every other opening a chair is welded so as to carry the spacing bar (and the reinforcing rods) the proper distance above the bottom of the slab. The floor rods are clamped solidly into place by a hammer blow, which easily bends the projecting metal strip tightly over the rod. The section of the bar is ⅜ sq. in., so that it serves also as a transverse, stiffening, or reinforcing rod. This spacer bar is being used for the first time in Canada on the Wm. Wrigley, Jr., factory, the contractors for which are the H. G. Christman Company.



Large Iron Fence Order

What is generally believed to be the biggest order for ornamental iron fence ever given in Canada, has been placed with the Page Wire Fence Company, at Walkerville. About 3,300 lineal feet will be required to fence in the ten-acre estate of E. Chandler Walker. The total cost of this fence, not including erection, will be in the neighborhood of $7,500. The fence is seven feet high and is composed of three horizontal rails. Pickets are ¾ inch square set 4 inch centres. A new record for quick delivery will probably be made on this order, which was placed in October and is to be delivered complete by December 1st. General Manager Church, of the Page Company, reports an unusually large amount of ornamental iron fence work running through the shops at this time. In fact, the fence business for the past year has been considerably better than it was during 1913, with every indication of a substantial increase in the coming year.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

The provincial government has authorized the town council to proceed with the construction of a filtration plant for this center. Mr. LeBlanc is the engineer, and Mr. Malherbe is the secretary.

Chatham, Ont.

Plans have been filed at the office of the Public Works Department, Ottawa, and Registrar of Deeds, Chatham, for the construction of intake pipe and concrete wall running out into Lake Erie, opposite the town line between the townships of Tilbury East and Romney. Mr. A. Farquharson, Merlin, Ont., is clerk of Tilbury East and Mr. J. W. Kennedy, Wheatley, is clerk of Romney.

Dundas, Ont. (Hamilton)

Plans are drawn by the town council for extensions to water mains on several streets at a cost of $1,500. Pipe and hydrants of standard size are to be used. Mr. R. W. Karch is the chairman.

Embro Township, Ont.

The Township Council is starting work on the laying of 6,800 ft. of tile in connection with the Youngsville drain, estimated to cost $2,145. The general contractors are: Mr. John Curtain, R. R. No. 2, Moncton, Ont., $530, and Mr. B. Blair, Woodstock, $1,615.

Eastview, Ont.

Work may be started shortly by the Town Council on the construction of a culvert through Hanna anad Overton Streets. Mr. Patterson Byrne, 93 Sparks Street, Ottawa, is engineer-in-charge.

Ottawa, Ont.

The purchase of three additional pumps has been recommended to the Water-Works Department, City Council, by Mr. R. L. Haycock, City Engineer.

Work on surface drainage and pavements on Gloucester Street has been started by day labor. Tenders are to be called for balance of work. The scheme will involve a total outlay of $23,000. Mr. F. C. Askwith is the engineer.

Quebec, Que.

Plans are drawn for the paving of St. Louis and St. Foye Roads at an estimated cost of $180,000. Mr. W. D. Bail[illegible], City Hall, is Engineer-in-Charge.

The City of Quebec is starting work [illegible] Mr. T. A. A. Forrester, Water-works Department, City Hall, is engineer. Work will be done by day labor.

South Vancouver, B.C.

The Municipal Council has completed arrangements for the paving of Main Street. Mr. J. B. Springford is the clerk

Stamford Township, Ont.

Tenders will be called by the Township Council for the supply of [illegible]

connections for houses at an estimated cost of $750. Mr. C. F. Munroe, Southend P.O., is the clerk.

Toronto, Ont.

Tenders close on December 8 with Board of Control for the supply of 567 ft. of 48-in. cast iron pipe and 400 feet of 66-in. cast iron pipe. Plans are at office of Commissioner of Works, Mr. R. C. Harris, City Hall.

Tenders close December 22 with Board of Control for reconstruction of part of section 2 high level interceptor. Plans may be inspected at office of Commissioner of Works.

York Township Council has decided to call for tenders to construct new sewers on Glenholme and Earnscliffe Avenues, at an estimated cost of $20,000. Mr. Frank Barber is the engineer.

Pavement is to be laid on Jane Street, from Dundas Street to St. Clair Avenue, for York Township Council. Estimated cost $5,000. Mr. Frank Barber, 57 Adelaide East, is the engineer.

Asphalt pavements on the following streets have been recommended by the Board of Control: Eaton, $11,348; Empress, $8,206; St. Clair, $29,489; Glenrose, $16,507; Heath East, $19,318; Elmwood, $3,294; Isabella, $5,138.

The Works Committee of the City Council has recommended that application be made for legislation to expend $50,000 upon the further extension of Crawford Street.

Waterloo, Que.

The Town Council will invite tenders in January for the contract to carry out about three miles of macadamizing, 16 ft. wide, estimated to cost $27,000. Mr. J. A. Perras is the assistant secretary-treasurer.

Winnipeg, Man.

Arrangements are under way at the instance of the Board of Control for the construction of sewers on several streets of this city. The work, which is estimated to involve an expenditure of $500,000, will be carried through during the winter by day labor. Mr. W. P. Brereton, 223 James Street, is the engineer.

CONTRACTS AWARDED

Port Hope, Ont.

The contract for the laying of 1,800 ft. of 14½-in. steel intake pipe has been awarded by the Board of Water Commissioners to Boyds, Limited, Port Hope. F. W. Thorold Company, Limited, 2 Toronto Street, Toronto, is the engineer. The work will cost about $15,000.

Toronto, Ont.

In connection with new water supply [illegible] North Toronto, the Board of Control has awarded the following contracts for supply of cast iron pipe:—National Iron Works, [illegible] lengths of 30-in. pipe, [illegible] per length; Canadian Allis-Chalmers, Limited, 566 lengths of 30-in. pipe, [illegible] per length; National Iron Works, 530 lengths of 36-in. (a) pipe, $94.45 per length; Canadian Allis-Chalmers, Limited, 440 lengths of 36-in. (b) pipe, $95.95 per length.

Victoria, B.C.

The City Council has awarded to the Canadian Mineral Rubber Company, Victoria, the contract for 12,000 yds. of asphalt surfacing at $1.05 per yd. Mr. Wellington J. Dowler is the clerk.

Railroads, Bridges and Wharves

Halifax, N.S.

Plans will be completed shortly for new dry dock, length 1,150 ft., width 180 ft., at an estimated cost of $3,000,000 for the Dominion Government Department of Public Works. Mr. R. C. Desrochers, Ottawa, is the secretary.

Louth Township, Ont.

The Township Council has decided to apply to the Grand Trunk Railway Company to reconstruct a bridge between lots 6 and 7, Con. 3. Mr. M. A. Ball Jordan, Ont., is the clerk.

Province of Ontario (Middlesex)

Tenders will be received by Mr. Chas. Talbot, C.E., London, Engineer of Middlesex, and Mr. Jas. A. Bell, C.E., St. Thomas, Engineer of Elgin; until December 8, for the construction of a steel bridge, one span, length 220 ft. with 225 feet of approach, concrete abutments, piers and pedestals, over Thames River, between the counties of Middlesex and Elgin, for the municipalities of Middlesex and Elgin.

Province of Manitoba

Tenders addressed to Mr. A. Johnston Deputy Minister of Marine and Fisheries, will be received up to noon, December 21st for the construction of a small wooden lighthouse [illegible] sheds with pole light [illegible] at Winnipegosis Harbour, [illegible] County, Province of Manitoba.

Saskatoon, Sask.

The Provincial Government Board of Highway Commissioners have temporarily suspended operations on new $75,000 bridge here. Seven-arch rings and false work for three main arches have been completed. Superstructure and approaches are to be finished next year.

St. Johns, Que.

The Provincial Government Department of Public Works (Hon. L. A. Taschereau, Minister), has awarded to Mr. Laurin Leitch, 5 Beaver Hall Square, Montreal, the general contract [illegible] between St. John and Iberville. Bridge will have 17 ft. roadway and 2 [illegible] asphalt floor and electric lighting. Two Strauss Trunnion [illegible] Estimated cost of bridge $175,000

St. Catharines, Ont.

Tenders will be received until December 2th by Mr. J. A. Pay, Town Clerk, for bridge superstructure on St. Paul Street, steel construction, length, 1,236 ft., width, 41 ft., height, 89 ft., for City Council. Mr. W. P. Near is the engineer.

Toronto, Ont.

Tenders close December 21 with the Board of Control for the construction of Rosedale Section, Bloor Street Viaduct, Toronto. The following is the engineer's estimate for quantities: 31,008 cu. yds. of excavating, 16,738 cu. yds. of concrete work, 4,854 sq. yds. of waterproofing, 485,350 lbs. of reinforcing steel. Steel work, including anchor bolts, sheet lead, plates, posts, bracings, floor beams, stringers, etc., 3,122,610 lbs. Mr. R. C. Harris is Commissioner of Works.

Vancouver, B.C.

The following contracts have been received for the Second Narrows bridge for the Burrard Inlet Tunnel & Bridge Company, 142 Hastings Street W.:—Canadian Bridge Company, Walkerville, Ont., $1,846,000; Dominion Bridge Company, Montreal, $1,916,000; Mr. C. A. P. Turner, Vancouver, $1,744,831. The structure will be steel and concrete. Messrs. Cleveland & Cameron, 1001-10 Rogers Building, are the engineers. Mr. J. E. Cockrell is the secretary.

CONTRACTS AWARDED

St. John, N.B.

The contract for the construction of a breakwater at Courtenay Bay has been let to Mr. J. A. Gregory, Lancaster W.E., St. John.

Public Buildings, Churches and Schools

Burnaby, B.C.

The School Board will start work at once on the construction of a $50,000 school here. The work will be under the supervision of the architect, Mr. J. H. Bowman, Yorkshire Building, Vancouver.

Bassano, Alta.

Tenders will be called shortly for plastering, heating and plumbing work in connection with the erection of a $25,000 government building for the Dominion Government Department of Public Works. The building will be two-storey, 40 x 56, sandstone, brick and steel construction. Mr. M. C. Sackrider, Medicine Hat, is the general contractor. The government architect is Mr. P. J. Dewey.

Carman, Man.

Tenders will be received by Mr. R. C. Desrochers, Secretary, Dominion Government Department of Public Works, Ottawa, until 4 p.m. December 9 for fittings in post office here, including screens, wickets, counters, furniture, cornice, drawers and pigeon holes. Plans and specification are at office of Mr. James Brown, Clerk of Works, Post Office, Carman; Mr. H. E. Matthews, resident architect, Winnipeg, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Limited, 25 Char- Street, Toronto.

Cornwall, Ont.

Tenders clos at 4 p.m. December 4 with Mr. R. C. Desrochers, Secretary, Dominion Government Department of Public Works, Ottawa, for electric wiring and fittings for post office. Building is to be wired for 78 60 watt, 29-100 watt, and 5-250 watt incandescent lamps and 70 switches, with fixtures and shades. Plans and specification are at office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F"; at Department, Ottawa, and with caretaker, Post Office, Cornwall, Ont. Specification at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Fort Frances, Ont.

Catalogues (with prices) on shelving, tables and chairs are wanted by Rev. J. R. Harris, Secretary, Library Board, in connection with the equipment of a $8,500 public library on Church Street and Victoria Avenue. Mr. W. A. Mahoney, Telephone Building, Guelph, is the architect.

Galt, Ont.

Tenders are open for heating, plumbing, interior fittings and furniture in connection with the construction of a $5,000 church on Water Street North, for the Baptist Congregation. Mr. John Girling, 50 Stone Road, is the architect and general contractor.

Grande Riviere, Que.

The parish of Grande Riviere have had plans drawn for addition to church. Mr. Thos. Raymond, 45 Caron Street, Quebec, is the architect. The building will be frame construction.

Hespeler, Ont.

Plans have been approved and tenders will be called in about two weeks for contract to construct $9,000 library for the Town Council. Messrs. Taylor & Bodley, Hope Chambers, Brantford, are the architects. Mr. M. E. Jardine is the clerk.

Kamouraska, Que.

Plastering, painting and heating tenders will be let next spring in connection with $52,000 church in course of construction for the parish of St. Louis. The Black Lake Construction Company, Black Lake, are the general contractors. Mr. Jos. P. Ouellet, 28 St. Famille Street, Quebec, is the architect.

Medicine Hat, Alta.

A by-law which was recently submitted to authorize the City Council to build a police station on Third and North Railway Streets, at an estimated outlay of $45,000, has been defeated. Another bylaw may be submitted next year. The proposed building will be two-storey, 65 x 40, brick construction. Messrs. Bourne & Morrison, Hooper & Huckvale Block, are the architects.

Milverton, Ont.

Sub-contracts for heating, plumbing, electrical work and interior fittings are to be let in connection with $26,000, 2-storey, brick post office in course of construction on Main Street for the Dominion Government Department of Public Works. Mr. J. S. Russell, 21 Downie Street, Stratford, is the architect. Mr. E. A. Bleakney, Elmira, is the general contractor.

Montreal, Que.

The R. C. School Commissioners will purchase electrical and interior fittings for school on Ottawa Street. Mr. W. E. Doran, 189 Bleury Street, is the architect.

Tenders will be received by Mr. R. C. Desrochers, Ottawa, Secretary, Dominion Government Department Public Works, until 4 p.m. December 2, for the contract to install interior fittings in Postal Station "H," including screens, counters, furniture, cornice, marble work, pigeon holes and drawers. Plans and specification are at office of Mr. L. A. Amos, architect, 78 Crescent Street, Montreal; Mr. R. L. Deschamps, overseer of Dominion Buildings, Post Office, Montreal, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Moncton, N.B.

The contract for interior fittings in connection with $62,000 church, 155 x 100, stone and brick construction, has not yet been let. Mr. James Reid is the general contractor. Mr. W. H. Lugsdin, 685 Main Street, is secretary-treasurer, First Moncton Baptist Church.

Notre Dame de Grace (Montreal)

Plans are drawn for a $25,000 church building to be erected on Kensington and Sherbrooke Streets for the St. Columbus congregation. Tenders have not yet been invited. Mr. David H. Macfarlane, 10 Cathcart Street, is the architect.

Niagara Falls, Ont.

Plans are in preparation and tenders will be called in December for the contract to construct an addition to school on Kitchener Street, estimated to cost $18,000, for the public School Board. Mr. C. M. Porter, Niagara Falls South, is the architect. Mr. Geo. Mortimer is secretary of School Board.

Owen Sound, Ont.

The Town Council has decided to submit a by-law to raise $5,000 for the purpose of carrying out alterations to asylum. Mr. Chas. Gordon is the Town Clerk.

Ottawa, Ont.

Contracts for plastering and painting $10,000 Sunday School on Florence Street for the First Congregational Church have not yet been let. Messrs. Weeks & Burgess, Sparks Street, are the architects. McArthur Bros., 26 Woodlawn Avenue, are the general contractors.

The City Council is contemplating the erection of an Old Men's Home on the outskirts of the city. The architect has not yet been appointed.

Work is to be stopped for this year on the construction of $20,000 church for St. Paul's Lutheran body. Foundations are about in, but no contracts have yet been awarded. New tenders will be called next spring. Building will be brick construction. Prices, etc., are wanted on seating and furniture. Mr. W. E. Noffke, 45 Rideau Street, is the architect.

Quebec, Que.

The contract has not yet been let for felt and gravel roofing in connection with the construction of $500,000 post office here for Dominion Government Department of Public Works. Building will be six-storey, 132 x 50, stone, marble, reinforced concrete and terra cotta construction. Mr. E. M. Talbot, 14 St. Joseph Street, is the architect-in-charge. Mr. Louis Boivin, 202 Richelieu Street, is the general contractor.

Saskatchewan Province

The following school districts in this Province have been empowered to borrow money for school improvements: West Lawn S. D. 3132, erecting and equipping School House, $2,200. Mr. Arch. McKerricher, Horizon, secretary-treasurer. Mullingar S. D. 2014, erecting School Building, $700. Mr. Chas. Comerford, Mullingar, secretary-treasurer. Broadacre S. D. 3087, erecting and furnishing School House, $2,000. Mr. Chas. H. Griffiths, Broadacre, secretary-treasurer.

Sandy Bay, Que.
Tenders will be invited next spring for the painting and heating of $75,000 church for Parish of Sandy Bay. Building will be 135 x 68, stone construction. Messrs. Ouellet & Levesque, 15 St. John Street, Quebec, are the architects.

St. Pierre du Lac, Que.
Tenders for plumbing and painting $70,000 church here will not be called before next spring. Mr. Rene Lemay, 19 d'Aiguillon, Quebec, Que., is the architect.

Simcoe, Ont.
Mr. R. Simpson, secretary of building committee, Trinity Church Congregation, will let the contracts for painting, heating, plumbing, electrical and interior fittings, in connection with parish hall in course of construction on Colborne Street, at a cost of $10,000.

St. Cesaire, Que.
Tenders will be received by the secretary of "Syndics" until December 1, for alterations to church. Mr. J. O. Turgeon, 55 St. Francois Xavier Street, Montreal, is the architect, at whose office plans and specification can be seen.

St. Epiphane, Que.
The parish of St. Epiphane, County Temiscouata, have had plans drawn for trimming interior of church at an estimated outlay of $15,000. Mr. Thos. Raymond, 45 Caron Street, Quebec, is the architect.

Toronto, Ont
The Property Committee of the Board of Education, together with the heads of departments, will form a committee to decide upon plans, etc., for the construction of new Administration Building in this city. Mr. W. C. Wilkinson is secretary-treasurer, Board of Education.

As part of the reorganization scheme of the Fire Department, the Board of Control contemplates the erection of a training school for firemen, possibly on College and Bellevue Street. A store-house for the supply department will also be built in connection with the scheme.

Tenders close on November 27th for addition to Regal Road school building for the Board of Education. Building will be brick and fireproof construction. Mr. W. C. Wilkinson is secretary-treasurer

Tenders and designs for leaded glass will close about December 1 with Mr. W. G. Burns, 74 Indian Grove Avenue, architect, in connection with new [illegible] church on [illegible] Avenue for Howard Park Methodist body. The hardware contract has not yet been let.

The Polish Catholics of West Toronto have purchased a site on Davenport Road upon which it is contemplated to erect a church next year.

Tenders close on November 27th with Mr. W. C. Wilkinson, Secretary, Board of Education, for miscellaneous school work, consisting of temperature regulators, electric wiring, metal and glass partitions and terrazzo floors in several school buildings. Plans are at office of superintendent of buildings.

Ville Emard, Que. (Montreal)
Work has been stopped for the present in connection with $150,000 church for the R. C. Parish of Ville. Sub-contracts will be awarded when work recommences. Mr. A. Bergeron, Terminal Tracks, Longue Pointe, is the architect. Mr. H. Tessier, Montreal, is the general contractor.

Wabamun, Alta.
Work is to start this year on the construction of a church on Railway Avenue for the Methodist Church Congregation.

Winnipeg, Man.
The plastering contract will be let later for library building in Cornish Park for the Board of Control (Library Board). The National Construction Company, Boyd Building, are the general contractors. Mr. S. Frank Peters, Phoenix Block, is the architect.

Building work on $225,000 church for Knox Presbyterian Congregation may be closed down for the winter. Mr. J. H. G. Russell, McArthur Building, is the architect.

CONTRACTS AWARDED

Ottawa, Ont.
The contract for painting, decorating and glazing of church on Division Street for the Italian R. C. church, has been awarded to Mr. T. B. Duford, 70 Rideau Street.

Business Buildings and Industrial Plants

Berthier, Que.
Plans are drawn and the contract will be let in a few days for the construction of $7,000 dormitory here for the Provincial Government, Department of Public Works. Building will be brick construction. Messrs. MacDuff & Lemieux, 104 Union Avenue, are the architects. Mr. C. Piche, Parliament Buildings, Quebec, engineer.

Berlin, Ont.
A by-law to authorize the construction of an incinerator plant, estimated to cost $14,000, for the City Council, will be voted on next January. Mr. A. H. Miller is City Clerk.

Blenheim, Ont.
The erection of a store, white brick construction, concrete foundation, estimated to cost $10,000, is contemplated by Mr. F. E. Phillips. The architect has not yet been appointed.

Daysland, Alta.
The construction of a skating rink this fall is contemplated by the town council. Mr. E. H. Dawson is secretary-treasurer.

Dundas, Ont. (Hamilton)
Plans are in progress for the construction of [illegible] sub-station for city council. Owing to [illegible] of the former tenders were returned and new plans are now being approved. Tenders will be invited shortly. Mr. Robert W. Karch is chairman, Public Utilities Commission.

Eden, Ont.
The construction of farm buildings at a cost of $3,500 is contemplated by Mr. Samuel Hicks, Exeter P.O.

Edmonton, Alta.
Work will be completed as soon as possible on lumber mill for Alberta & Great Waterway Railway. Machinery capable of turning out 200,000 ft. of lumber daily will be installed in connection with the plant.

East Nissouri, Ont.
Rebuilding of cheese factory recently destroyed by fire is contemplated by the owners, Messrs. Connolly Bros., Ingersoll P.O. Work is to start this year. A quantity of fire bricks will be purchased.

Falkenburg, Ont.
The saw mill owned by Mr. Arthur Moore has been completely destroyed by fire.

Fernie, B.C.
Tenders will be called shortly, but operations will not be started until the spring in connection with the construction of drill hall for the Dominion Government Department of Militia and Defence. Estimated cost $25,000. Mr. Forde, Nelson, B.C., is the architect.

Harris, Sask.
A roller mill owned by Goose Lake Roller Mills, has been destroyed by fire. Damage to building, estimated at $30,000, is covered by insurance.

Halifax, N.S.
The erection of a store and factory on Barrington and Argyle to replace building destroyed by fire, is contemplated by Mr. Frank Reardon, 56 Barrington Street, owner. Mr. H. E. Gates, Barrington Street, is the architect.

Store and office recently destroyed by fire will be rebuilt by the owner, Mr. J. E. Roy, Roy Building, Barrington Street. Mr. A. R. Cobb, Cragg Building, is the architect.

Hamilton, Ont.
Sub-contract for electrical work in connection with $30,000 factory on Margaret Street, will be let shortly. McGregor Shirt Company, 19 Hughson Street S., are the owners. Building is three storeys, 103 x 43.

London, Ont.
Plans are being prepared for new store fronts to store on Dundas Street for Mr. S. F. Glass, M.P., Pottersburg P.O., London Junction. Messrs. McBride & Gilbert, [illegible] Block, are the architects.

Maisonneuve, Que. (Montreal)
Heating, plumbing and electrical work will be let shortly by Mr. J. J. York, 730 Notre Dame, architect, in connection with [illegible] warehouse, four storeys, [illegible] x 80, brick construction, for St. Lawrence Sugar Refineries, Limited, 145 St. James Street.

Medicine Hat, Alta.
Medicine Hat Curling Club, Limited (manager Mr. John Benson), are repairing building after fire.

A new foundry building for the [illegible] Iron & [illegible] Works, [illegible] has been completed at a cost of [illegible]. Machinery has not yet been installed. Mr. Geo. Harrison, 8 Connaught Avenue, is managing director.

Montreal, Que.
As work progresses on erection of stables on Western Avenue for Mr. Ar-

(Continued from page 63)

Tenders and For Sale Department

Tenders for Sewer Construction

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to **noon** on December 22nd, 1914, for the reconstruction of part of Section No. 2, High Level Interceptor.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
Toronto, November 19th, 1914. 47

Tenders for Sewer Construction

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to **noon** on **Tuesday, December 8th**, for the construction of the following sewers, viz.:—

Annette Street, Woodville Ave. to Western Avenue;

Brighton Place, Western Avenue to Indian [illegible]

Copeland Avenue, West Lynne Avenue to Roseheath Avenue;

East Lynne Avenue, Danforth Avenue to south [illegible]

Indian Road, Conduit St. to Humberside Avenue;

Merrill Ave. East, Moberley Ave. to East Lynne Avenue;

Merrill Bridge Road, West Lynne Ave. to East Lynne Avenue;

Moberley Avenue, Danforth Avenue to Daubac Avenue;

West Lynne Avenue, Danforth Avenue to South end;

West Toronto Sewer System, Div. No. 2, Outlet, High Park, Section No. 1.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
[illegible] 1914 47

Tenders for Supply of Cast Iron Pipe

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to **noon** on **Tuesday, December 8th, 1914**, for the supply of

567 feet of 48-inch cast iron pipe
400 feet of 66-inch cast iron pipe.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman, Board of Control.
Toronto, November 19th, 1914. 47

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Freight Elevator, Ottawa City Post Office, Ottawa, Ont.," will be received at this office until **4 p.m. on Wednesday, December 9, 1914**, for the installation of one (1) standard freight elevator in the Ottawa City Post Office, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department, at the offices of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. R. L. Deschamps, Superintendent of Public Buildings, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which wil be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, November 18, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 70253. 47-48

Wanted

A gyratory rock crusher, No. 6 or 7½.

THE OLIVER ROGERS STONE CO.,
1170 First Avenue West,
47 Owen Sound, Ont.

TENDERS

Bulk or separate tenders will be received by the undersigned until **5 p.m. December 1st, 1914**, for all trades required in the erection and completion of a Business Block to be erected in St. Catharines, Ont., for J. Widdicombe.

Plans and specifications may be seen at the office of the Contract Record, 347 Adelaide Street West, Toronto, Ont., or at A. E. Nicholson's office, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
47 St. Catharines, Ont.

To Contractors

Sealed tenders address to either of the undersigned will be received until noon on **Tuesday the 8th day of December** for building a steel riveted truss bridge over the River Thames between the Counties of Elgin and Middlesex (known as the Tait Bridge) length of span C to C, 220 feet and also for the steel beams and railing required for 255 feet of approach. Also for the concrete work consisting of abutments, piers and pedestals.

A certified cheque payable to the Treasurer of one of the Counties for 5 per cent. of the amount of tender must accompany tender. Plans and specifications may be seen at the office of the undersigned. Lowest or any tender not necessarily accepted.

JAS. A. BELL, C.E.,
Engineer for Elgin, St. Thomas.

CHAS. TALBOT, C.E.,
46-48 Engineer for Middlesex, London.

Sales Engineers Wanted

Sales Engineers wanted to sell a new pipe cleaning device for cleaning water mains in Canadian towns and cities. Box 102, Contract Record & Engineering Review, Toronto. 45-47

Sales Engineers Wanted

A large firm specializing in the manufacture of motors of all classes desires to secure sales engineers in various parts of Canada. Firms who can carry a stock of motors are preferred. Write stating the territory you can cover. Box 96, Contract Record & Engineering Review, Toronto. 44-47

Agents Wanted

We are open to appoint Provincial agents for our frost proof water meters. Adopted by leading towns and cities in Northern States. Apply Box 103, Contract Record & Engineering Review, Toronto. 45-47

Representatives Wanted

U. S. Paint and Varnish Manufacturers want representatives who are well acquainted with leading Architects and Contractors, in each Canadian province. Exclusive Provincial agencies will be given to right parties. Box 104, Contract Record, Toronto. 45-47

Sales Agents Wanted

Firm making "U" Support Ties and Bar Supports for Concrete Work wants sales agents throughout Canada. Apply Box 98, Contract Record & Engineering Review, Toronto. 45-47

Lines Wanted

Firm opening Contractors' and Builders' Supply Yard in a large Western Ontario city would like to secure a few more good lines. Forward full descriptive matter to Box 105, Contract Record, Toronto. 46-47

mand Malo, 100 St. Jerome Street, at an estimated cost of $20,000, sub-contracts will be let by the architect, Mr. Sydney Comber, 1215 Green Avenue, Westmount. Building will be three-storey, 120 x 25, steel, brick and reinforced concrete construction.

A soap factory on St. Catherine Street East, the property of Compaigne de Savon Francais, 1550 St. Catherine East, has been destroyed by fire. Extent of damage is not reported. Company will probably rebuild.

Niagara Falls, Que.

A modern garage is to be erected by Mr. J. H. McGarry, Huron Street, to replace portion destroyed by fire recently at a loss of $2,000.

New Westminster, B.C.

Tenders on all trades will be invited shortly in connection with construction of elevator and warehouse on Front Street, at an estimated cost of $50,000, for Messrs. Brackman-Ker Milling Company. The architects are Messrs. Gardner & Mercer, Trust Building. Owners will start work by day labor in about two weeks.

Ottawa, Ont.

Sub-contracts for plastering and painting $16,000 theatre on Rochester Street for Mr. P. J. Nolan have not yet been let. Mr. W. G. Davis, 5 Spruce Street, is the architect.

Quebec, Que.

Plans are drawn for one-storey ice plant, 53 x 92, brick construction, concrete foundation, on Renaud Avenue, at an estimated cost of $7,000 for the Arctic Ice Company, Limited. Mr. J. L. Lachance, St. Paul Street, is the manager.

Redcliffe, Alta.

The erection of drying sheds at an estimated cost of $2,500, brick construction, is to be commenced shortly by the Redcliffe Brick & Coal Company.

St. Thomas, Ont.

Plans have been drawn by Mr. John T. Findlay, architect, for $3,000 garage [illegible] Mr. Geo. Spackman.

St. Catharines, Ont.

Tenders will be received by Mr. A. E. Nicholson, 40 Queen Street, architect, until 5 p.m. December 1st for all trades in connection with the construction of stores and offices here for Mr. J. Widdicombe, [illegible] Street. Plans and specifications are at office of architect and MacLean Daily Reports, Limited, [illegible] Charlotte Street, Toronto.

Tilbury, Ont.

Fittings and equipment will be required by Mr. Gordon McKay, c/o N. M. Emery, Tilbury, who is altering store into confectionery and bakery.

Toronto, Ont.

Tenders are in but contracts have not yet been awarded on six-storey warehouse, brick construction, to be erected at 280 King Street W., for Messrs. Anderson-McBeth, Limited, 76 Bay Street. Mr. Wm. Fraser, 34 Victoria Street, is the architect.

Westmount, Que. (Montreal)

Plans are drawn by the architect, Mr. Sydney Comber, 1215 Green Avenue, for $2,000 garage for Mr. A. R. Whittall, 544 Roslyn Avenue.

CONTRACTS AWARDED

Maisonneuve, Que. (Montreal)

Sub-contract for electrical work on $70,000 warehouse for St. Lawrence Sugar Refineries, Limited, has been awarded to Goodwin, Limited, St. Catharine Street W. Building is four-storeys, 130 x 80, brick construction.

Ottawa, Ont.

Additional contracts have been awarded as follows in connection with steel reinforced concrete factory building, estimated to cost $15,000, for Mr. Robert Brown, 367 Sparks Street:—Painting, Mr. W. C. Carson; heating, Mr. J. T. Blyth; plumbing, Mr. J. Booth .

Contracts for mason work on two stores to be erected on Bank Street for Oakland Land Company, at an estimated cost of $9,000, have been let to Mr. B. Dougherty, 16 Cayuga Street; carpentry to Mr. Walter Fryer, 5 Glen. Tenders are still being received for plastering, painting, heating, plumbing and electrical work. Stores will be brick veneer construction.

The contract for addition to candy factory on Slater Street at an estimated cost of $6,000 for Mr. W. Nixon, 118 Slater Street, has been awarded to Messrs. James & Ramsay, 70 Fairmont Avenue. Building will be solid brick construction, concrete foundation. Some machinery will be required.

Residences

Anderdon Township, Ont.

The erection of a $3,500 residence, white brick construction, is contemplated by Mr. Theo. Wismer, Malden Road, Essex P.O.

Barrie, Ont.

Material will be purchased by Mr. Wm. Booth, owner and general contractor, in connection with a new residence on Sanford Street, brick construction, concrete foundation.

Chatham, Ont.

Sub-contracts for heating and electrical work have not yet been let in connection with new residence for Mr. Herbert White, 213 Joseph Street. Messrs. White Bros. are the general contractors.

Elmwood, Man. (Winnipeg)

The erection of five residences next spring is contemplated by Mr. C. F. Newman, 501 Keewayden Building, Winnipeg.

Guelph, Ont.

Plans for two-storey residence on [illegible] Street, have been drawn by Mr. [illegible], Guelph.

Permits have been issued to Mrs. A. Watson, Ontario Street, and Mr. W. S. Clough, Stenenson Street, for the erection of two residences here.

Plans are prepared for the erection of a residence on Sydenham Street. Mr. J. J. Chickley, Neeve Street, has the mason contract.

Hamilton, Ont.

Plans are in progress for residence on Sherman Avenue for Mr. R. S. Mason, 21 Somerset Avenue, owner and architect. Tenders for materials will be received by owner for about ten days. Residence will be 1½-storey, 22 x 30, stone and buff brick construction.

Sub-contracts for painting and electrical work will be let shortly in connection with $4,000 residence on Aikman Avenue, for Mr. J. A. Stuart, King and Wentworth Streets.

Halifax, N.S.

The construction of a number of residences on St. Albans, this city, is contemplated by Mr. H. McHart, 151 Lockman Street.

The construction of two $6,000 residences on Larch Street is planned by Messrs. Lownds & Smith, 81 Cobourg Road.

The erection of a frame residence estimated to cost $3,500 is contemplated by Mr. John McKay, 17 Wright Avenue.

Headingly, Man.

A number of residences will be built in December or next spring by Mr. C. F. Newman, 501 Keewayden Block, Winnipeg, Man.

Longue Pointe, Que. (Montreal)

Sub-contracts will be let as required by Mr. J. O. Turgeon, 55 St. Francois Xavier Street, architect, in connection with the construction of $45,000 residence on Dickson & Lamothe for the Franciscan Fathers, 964 Dorchester Street West. Building will be three-storeys, 122 x 37, stone construction.

London, Ont.

Plans are in preparation and tenders will be called shortly for the construction of a residence on Dundas Street for Mr. M. Lerner, 502 Hill Street. Mr. J. V. Monro, Bank of Toronto Building, is the architect.

Chairs and electrical fixtures will be required in connection with alterations to store on 384 Richmond Street, for Mr. B. Lamb. Jones Bros. are the general contractors.

Montreal, Que.

A permit has been issued to Mr. A. E. Larose, 1282 Delormier Street, to build six flats here, at an estimated cost of [illegible]. Building will be three-storeys, 50 x 79.

Plans are drawn for [illegible] for Mr. Ernest Parent, 2137 Christopher Columbus Street.

Niagara Falls, Ont.

Tenders are to be called by Mr. John Robinson, S., 15 Simcoe Street, for the contract to repair residence recently damaged by fire.

Oshawa, Ont.

Revised tenders are now open with the architects, Eden Smith & Son, [illegible] Yonge Street, Toronto, for 2½-storey brick residence for Mrs. Pedlar. Estimated cost [illegible].

Ottawa, Ont.

Contracts will be let for smaller trades than masonry and carpentry, in connection with [illegible] residence on [illegible] Street for Mr. [illegible]

[illegible] Street, who is also the general contractor.

The construction of a residence on O'Connor Street is planned by Mr. Wm. Delaney, 22 Fourth Avenue.

Plans are in progress for the construction of a brick veneer residence on Wurtemburg. Mr. J. B. Maclaren, 104 Sparks Street, is the architect.

The erection of a $4,000 residence on Spadina is contemplated by Mr. J. B. Villeneuve, 104 Bayswater Avenue.

The erection of a residence, brick veneer construction, stone foundation, at an estimated cost of $4,200 for Mr. W. C. Leach, 140 Spadina Avenue, is contemplated.

Prices are being taken on plastering, painting, heating, plumbing and electrical work in connection with the construction of a residence on Irving Street, for Mr. W. C. Leach, 140 Spadina Avenue.

Tenders for plastering, painting, heating, plumbing and electrical work will be received by Mr. Wm. Spratt, Sunnyside Avenue, general manager and architect, in connection with the construction of a 2½-storey, 28 x 25, brick veneer residence on Willard estimated to cost $6,000 for Oakland Land Company, c/o C. C. Ray Company, Sparks Street.

The erection of three attached residences on Beverly Street at an estimated cost of $6,500, brick veneer construction, is contemplated by Mr. Thomas Dean, 170 Cambridge Street.

The contract for electrical work has not yet been let in connection with $4,000 residence in course of construction at Rosemere for Mr. Wm. Glennie, 183 Hawthorne Street.

The erection of a $4,500 residence on Lisgar Road is contemplated by a resident, c/o Mr. Baxter, 34 McLaren Street.

The building of a double residence on Bellwood, estimated to cost $5,000, is in contemplation by Mr. B. A. Grison, 100 Fentiman Avenue. Residence will be concrete block construction, concrete foundation.

Excavating is under way but plans have not yet been completed for $4,500 residence for Mr. Stanley Smith, Spadina Avenue. Tenders will be called for plastering, painting, heating, plumbing and electrical work as soon as they are ready.

The erection of two residences on Nelson Street, double brick veneer construction, estimated to cost $6,500, is contemplated by Mr. Donald Fraser, O'Connor Street.

Prices are being taken on plastering, painting, heating, plumbing and electrical work in connection with the construction of residence, stables, etc., in the west end at an estimated cost of $12,000, for Mr. J. Gorman, Minto Hotel. Mr. Frank Sullivan, Castle Building, Queen Street, is the architect. Work will be done by day labor.

Quebec, Que.

The contract for heating new $7,000 residence for Emile Frenette, 84 Cremazie Street, four-storey, 50 x 50, frame and brick construction, has not yet been let.

South Edmonton, Alta.

Plans are drawn for two-storey residence on 89th Avenue for Mr. R. McKenzie, Parliament Buildings, at an estimated cost of $4,000.

Toronto, Ont.

The contracts for roofing, plastering, painting, heating, plumbing and electrical work have not yet been let in connection with $4,500 detached residence, two-storeys, 24 x 42, brick construction and foundation, for Messrs. Spanner & Cranfield, 54 Brunswick Avenue.

CONTRACTS AWARDED

Ottawa, Ont.

The mason contract for the construction of double residence on Somerset Street at an estimated cost of $8,000, brick veneer construction, stone foundation, has been awarded to Mr. R. J. Watson, 186 Hawthorne Street. Mr. Donald Fraser, O'Connor Street, is owner and architect.

The following contracts have been let in connection with $5,200 residence on Fentiman Street for Mr. B. A. Grison, 100 Fentiman Street: Plastering, Mr. J. Overton; painting, Messrs. Navin & Fairhurst, Ottawa W.; heating and plumbing, Mr. J. P. Band; electrical work, Mr. J. L. Allan.

Power Plants, Electricity and Telephones

Mount Forest, Ont.

A by-law to authorize the installation of hydro power will be voted on by the ratepayers next January. Mr. W. C. Perry is the town clerk.

New Denver, B.C.

Plans are being prepared for the erection of a power plant to replace the one recently destroyed by fire. The New Denver Light & Power Company will also extend its transmission lines into adjacent districts.

Orillia, Ont.

The contract for the proposed new pumping station for Orillia Water, Light and Power Commission has been awarded to Norman M. McLeod, Limited, of Toronto and Montreal. The contract for pipe laying was awarded to Mr. H. Caswell, of Orillia; cast iron pipe to the National Iron Works, Toronto; valves to the Kerr Engine Company, Walkerville. The machinery contracts have not yet been let.

Reston, Man.

The installation of electric power and the purchase of fire fighting apparatus is contemplated by the Board of Trade here. Mr. A. B. Chapman is president. Mr. A. P. Power is the engineer.

Sudbury, Ont.

Surveys have been completed for the construction of an electric railway from Sudbury to Copper Cliff, a distance of approximately five miles, for the Sudbury-Copper Cliff Suburban Electric Railway Company. Mr. J. H. Mackey is president.

St. Stephen, N.B.

Plans for the construction of a power house and dam have been filed at the Department of Public Works, Ottawa. The Sprague Falls Manufacturing Company, Limited, owners, will apply for approval of plans to construct dam, power house and power canal on the St. Croix River, near Grand Falls, Charlotte County, N.B.

Williamsburg, Ont.

A by-law has been approved here for the construction of an electric power plant at an estimated cost of $2,750 for the Municipal Council. It is stated that work will be done by day labor under the supervision of the Hydro-Electric Commission of Ontario, Toronto.

Miscellaneous

Edmonton, Alta.

The ratepayers here will vote on a by-law about December 15th to authorize the raising of $150,000 for a natural gas system and piping gas from Viking to Edmonton. If the scheme is successful a sum of $2,000,000 may be expended on a complete system for the city of Edmonton. Those interested include Mr. W. J. Magrath, president, Industrial Association, Highlands, Edmonton, and Mr. W. R. Martin, president, International Supply Company, Medicine Hat.

Glencoe, Ont.

Equipment will be purchased by Mr. H. F. McAlpine, care Duncansons Garage, who is entering the general machine and auto repair shop business here.

Plans are in progress by city council for remodelling and brick-veneering entrance to Lansdowne Park, at an estimated outlay of $3,500. The architect is Mr. W. E. Noffke, 45 Rideau Street.

Galt, Ont.

Tenders will be received by Mr. Joseph McCartney, town clerk, for a fire alarm system for the town. Specification is to be submitted for a town of 12,000 population with an area of 1,600 acres. No date has been fixed for closing of tenders.

Ottawa, Ont.

Tenders will be received by Mr. R. C. Desrochers, secretary, Dominion Government Department Public Works, Ottawa, until 4 p.m. December 9th; for the installation of one standard electric freight elevator in the post office. Plans and specification are at office of Mr. Thos. A. Hastings, clerk of works, Station "F," Toronto. Mr. R. L. Deschamps, Supt. of Public Buildings, Montreal, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Toronto.

Toronto, Ont.

Chapman & Walker, Limited, engineering supplies, etc., have assigned. It is reported that a winding-up order has been granted.

CONTRACTS AWARDED

Brantford, Ont.

The contract to supply foundation for monument to be erected on West Street, at an estimated cost of $3.000, has been awarded by the Bell Memorial Committee to Messrs. Schultz Bros. Company, Limited, Brantford. Messrs. Barber & Tilley, Temple Building, are the engineers.

Toronto, Ont.

The Board of Control has let the general contract for alterations at high level station, including concrete foundations in engine and boiler room and trench laying, to Page & Company, Queen's Park, at $3,500.

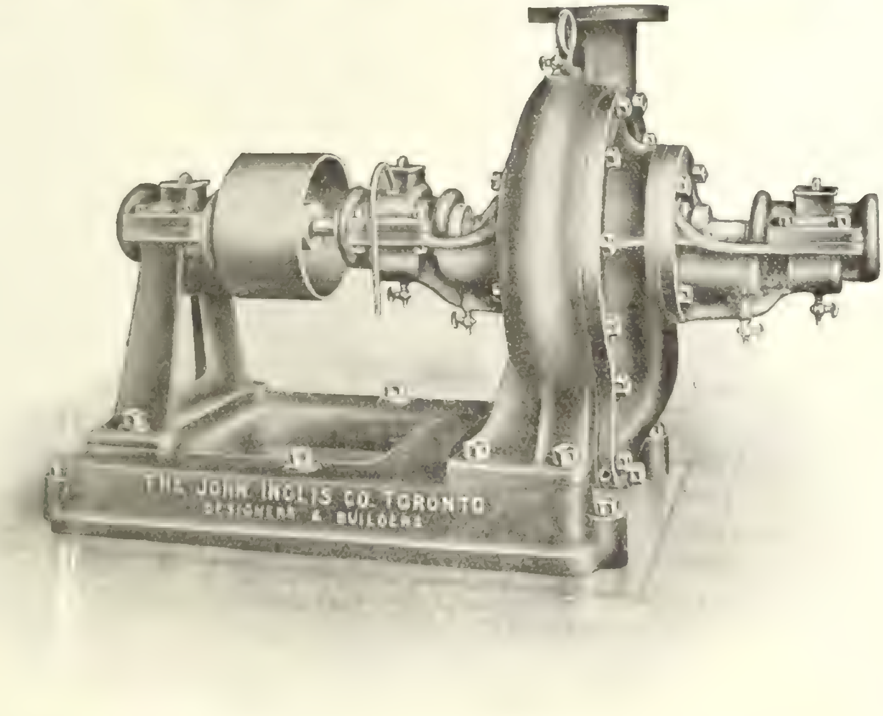
Vancouver, B.C.

The contract for installing heating system in two glass houses in Stanley Park for the City Council, has been let to Orr Bros., Vancouver, at $695.

Windsor, Ont.

The Dominion Government Depart-

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

[illegible] Marine & Fisheries, Ottawa, has awarded the contract to Mr. A. T. C. McMaster, Toronto, for cribwork substructure 40 ft. square, 17 ft. high, 12-in. timber, reinforced tower 35 ft. high, steel [illegible] ladder, also ventilators, in connection with new lighthouse tower for Livingston Channel, Detroit River. The general contractor is receiving prices on hemlock, 12 ft. to 22 ft. long, [illegible]

Late News Items

Cardston, Alta.

Tenders are now being considered for the contract to supply brick for interior [illegible] $800,000 temple for Latter Day Saints. Tenders for furnishing and finishing granite for exterior of temple will be received immediately. Bids for structural steel will be called next spring. Work on building will now be stopped for the winter. Messrs. Pope & Burton, Salt Lake City, are the architects. Mr. H. A. Christenson, Calgary, is superintendent of construction.

Cranbrook, B.C.

A supply of valves and hydrants will be required in connection with $80,000 water system for the City Council. A further contract for the construction of 1,000,000-gal. concrete reservoir, replacing present wooden water pipes with steel pipe, has been let. The general contractors are Messrs. Hotson, Leader & Goode, Lethbridge, Alta.

Edmonton, Alta.

A stationary factory, the property of Bradburn Stationary, 102nd Street, has been damaged by fire. The loss is estimated at $18,000.

Maisonneuve, Que. (Montreal)

Tenders for separate trades will be called next month by the architect, Mr. Marins Dufresne, Ontario & Lasalle Streets, for new fire and police station here, estimated to cost $70,000.

Medicine Hat, Alta.

The contract for the 3,000,000-gal. resservoir, in connection with the Medicine Hat Waterworks, which was completed recently, was carried out by Messrs. Hotson, Leader and Goode, Medicine Hat, Alta. It was erroneously stated in the Contract Record of November 11 that the work was done by the Canada Cement Company, Limited.

Montreal, Que.

Tenders close about November 30 with the architect, Mr. Raoul Gariepy, 25 St. James Street, for sub-tenders in connection with the construction of three flats on Visitation Street, three storeys, 33 x 85, brick construction, at an estimated cost of $15,000. Mr. L. Belanger, 709 St. Catherines Road, is the owner.

Ottawa, Ont.

The City Council has in contemplation the erection of a bridge with concrete abutments and steel substructure, on Fairmont Avenue. Mr. F. C. Askwith is city engineer.

Peel, N.B.

A loss estimated at $15,000, partly covered by insurance, has been sustained by the Canadian Pacific Railway and other owners in the destruction by fire of railway station and four warehouses at this centre.

Quebec, Que.

The "Commercial" Academy, the property of the R. C. School Commissioners, which was destroyed by fire recently at a loss estimated at $60,000, will be rebuilt. Structural requirements will include stone, brick, concrete, hot air heating, electrical fixtures, school furnishings, asbestos, hardwood floors and metal roofing. Mr. J. B. Morissette, 111½ Grande Allee Street, is the architect.

Regina, Sask.

The following contracts have been awarded by the City Council (Waterworks Department) for water meters: National Meter Company, Winnipeg, one 3-in. Empire compound meter, $162.50; two 2-in. Empire AAX type 9, $78; Messrs. Walsh & Charles, Winnipeg, ten 2-in. trident disc meters, $65. All f.o.b. Regina.

St. Hilaire, Que. (Montreal)

The architects, Messrs. Aquin & Brault, New Birks Building, Montreal, are taking prices for general contract on addition and alterations to residence of Hon. Judge Paul Martineau, St. Hilaire. Work will begin immediately after award of contract.

Toronto, Ont.

Some of the smaller trades will be sublet by Mr. P. L. Spiers, 70 Shuter Street, owner, who is constructing one pair of residences on Lauder Street at a cost of $5,000, 2½-storey, stone and brick construction.

Tenders are now open with the architect, Mr. J. M. Cowan, 65 Adelaide Street East, for additional masonry, carpentry and steel trades in connection with addition to laundry on Bathurst Street for Taber's Laundry.

Vancouver, B.C.

The following sub-contracts have been awarded in reference to new $20,000 office building on Hornby Street, for the National Mercantile Company, 420 Winch Building, Vancouver:—Plumbing, Barr & Anderson, Vancouver; steel work, Messrs. J. Coughlan & Sons, Vancouver. Other sub-contracts will be awarded shortly. The building will be steel, mill and brick construction. Mr. Glover Lloyd, Vancouver, is the general contractor.

Whitehead Township, Man.

Plans and specifications are with the secretary-treasurer, Mr. M. Eaton, Alexander P. O., who will receive tenders until noon, December 16, on behalf of the municipality of Whitehead, for repairing west approach to McMillan Bridge, Section 34, Twp. 10, Range 20.

New Companies

The Canadian Tar Products Company, Limited, has been incorporated with a capital stock of $500,000, for the purpose of mining and purchasing, selling and otherwise disposing of iron, limestone, ores, minerals, ets. The company's head office is at Montreal, Que. The provisional directors include Mr. E. Malcolm McDougall and Mr. Gilbert Sutherland Stairs, both of Montreal.

The Westlake Brick and Products Company, Limited, has been incorporated with head office at Wellington, Ont., to manufacture and deal in brick, stone, lime, etc. The company has a capital of $250,000. Those interested include Mr. H. A. Rose, Sr., 33 Fraser Street, Welland, and Mr. H. A. Rose, Jr., 41 Fraser Street, Welland.

The Parkhill Lumber & Manufacturing Company, Limited, has been incorporated with a capital of $30,000, with head office at Parkhill, Ont., to carry on the business of lumber, saw and planing millers. Mr. W. H. Mark, Station Street, is said to be interested.

St. Catharines Silk Mill, Limited, has been incorporated with head office at St. Catharines, Ont., and a capital of $100,000. Provisional directors are B. S. Griffin, E. R. Griffin, and A. G. Griffin, all of Buffalo, N.Y.

Canada Grain Securities, Limited, c/o Phillips, Rogers & Scarth, barristers, has been incorporated with head office at Winnipeg, Man., with power to conduct general grain business, own and operate elevators, warehouses, mills, etc. The company's capital is $200,000.

The Chaleur Pump & Lumber Company, Limited, has been incorporated with a capital stock of $75,000 and head office at Montreal, to carry on the general lumbering business, manufacture of pulp, etc. The incorporators include Mr. Howard Salter Ross, Mr. Eugene R. Angers and Mr. Jos. Greig Robertson, all of Montreal.

Nairns' Falls Power and Pulp Company, Limited, has obtained a Dominion charter for the purpose of constructing and operating mills for the manufacture of pulp and paper. The capital stock is $100,000 and the company's chief office is at the village of Malbaie, Que. The provisional directors include Mr. Louis Alexandre Martin, civil engineer, and Mr. Riel Papin, both of Montreal.

Superior Tubes and Accessories, Limited, has been incorporated as manufacturers of automobiles, automobile accessories, also manufacturers of iron and woodworking tools and machinery. The company has a capital stock of $300,000 and the head office is at Toronto, Ont. Messrs. Wm. Alfred J. Case, solicitor, James Broadbent Taylor, accountant, and Clifford Gordon Lynch, secretary, all of Toronto, are amongst the provisional directors.

The Dominion Foundation Company, Limited, has been incorporated with a capital stock of $50,000, as building contractors. The Company's head office is at Montreal.

The Fleming Publishing Company, Limited, has been incorporated with chief office at Owen Sound, Ont., with capital of $40,000. Mr. C. A. Fleming, 566 Ninth Street E., is interested.

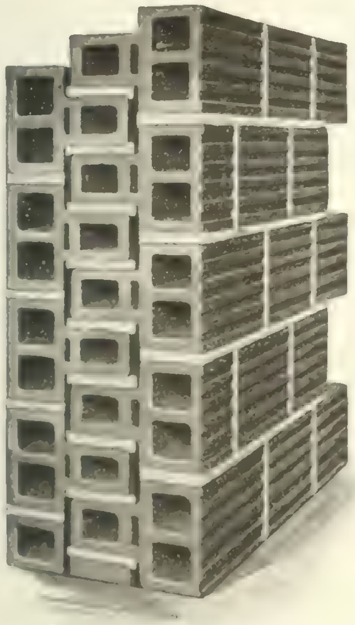
The Barton Sand & Gravel Company has obtained incorporation with power to deal in sand, gravel and building materials. The company's head offiffice is at Hamilton, Ont., and the capital stock is $100,000. Dr. E. A. Alway, Bartonville, Ont., is interested.

It is said that the first sawmill in the United States was at Jamestown, from which sawed boards were exported in June, 1607. A water power sawmill was in use in 1625 near the present site of the city of Richmond, Va.

There are said to be more than 400 different kinds of marble used in New York City, and in color they range from bright reds and greens to the most delicate shades of pink, turquoise and yellow. Some are known as dead stones because of their flat, sombre hues, while others are alive with dashes of vermillion, scarlet, emerald green and lavender.

DENISON

Interlocking Hollow Tile



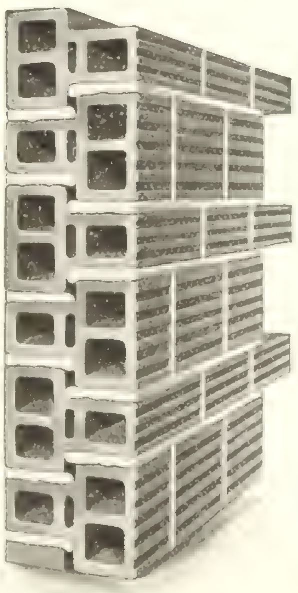
Twelve Inch Wall

The one size and shape builds all thicknesses of walls.

Denison Interlocking Hollow Tile, the modern building material, possesses bonding and interlocking properties unequalled by any other tile.

When Denison Tile is used in wall construction, there are no mortar joints extending through the wall to carry moisture. This feature, together with many dead air spaces, renders the Denison Tile wall impervious to moisture, heat, cold and sound.

Denison Hollow Tile is fireproof.



Eight Inch Wall

Orphanage for I.O.O.F. BUILT LIKE A THERMOS BOTTLE Oakville, Ont.

Architect:—Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.

SUN BRICK COMPANY, LIMITED

The One Price Company

Traders Bank Building **TORONTO, ONTARIO**

Current Prices of Building and Engineering Materials

General Review of Market Conditions

T[illegible] of severe weather [illegible] is beginning to effect some[illegible] general conditions in [illegible] An important percentage of [illegible] is on the way to completion and contractors who are in a position to do [illegible] work that has been on hands [illegible] In these circumstances there is almost invariably a lull in constructional activity [illegible] months prior to the opening up of building operations in the spring. With these facts in mind it is a moot point whether the [illegible] at the present time is to any marked extent more pronounced than it has been at corresponding dates in past years. While little change is manifest since last month, yet on the whole there are evidences of improvement in various parts of the building field. For instance, there is an air of increased confidence, created largely from the prospects of greatly stimulated trade through the many openings for business development which have taken place as a result of the war. The indirect benefit resulting [illegible] in the trade situation has already become apparent. It is anticipated that increased requirements will stimulate building construction, particularly in the way of extensions to factory plants, whilst the anticipated boom in immigra[illegible] countries following the war, will open up the way for the immediate con[illegible] residences.

In the brick field there is little business activity. The completion of extensive constructional undertakings is accountable for the execution of several orders by manufacturers, apart from which business is very quiet. Quotations, too, are decidedly more elastic at the present time than has been the case for some considerable time past. Taken as an average the standard rates in certain classes of brick have dropped from $2 to $5 per thousand. Against this, however, should be placed the fact that indirect benefit has accrued to the trade through the filling of important orders received through government channels, the necessity having arisen in several instances for extensions to factory plants. One brick firm reports the netting of a substantial order for brick on this account. Cement and lime being closely allied in the category of building materials, the movement is slow, nevertheless a tone of confidence prevails amongst manufacturers which cannot but re-act enormously to the advantage of trade generally.

The market for steel is quiet, though several firms throughout Canada who are executing important orders for government military requirements have assumed notable activity, several of the plants having been working at capacity for several weeks past. Conditions in the lumber trade are unchanged. Most of the demand in the large cities is for consuming manufacturers. A considerable reduction in stocks of every description is anticipated next spring by many manufacturers and the feeling is pretty general that the most noticeable characteristic of the trade early next year will be a moderate demand. Viewed in the abstract the conditions and future prospects of the building trade are much more reassuring than appeared on the surface some time ago.

At Montreal business in the building and allied trades continues quiet. Work is being finished up on many of the contracts, and the new work in sight is not of great importance, although builders have been tendering on three or four fair-sized jobs. Supply firms report a falling off in orders, due partly to the lateness of the season, but country business is keeping up very well. The Montreal Council have mapped out an extensive programme for next year, notwithstanding the acknowledged difficulty in the matter of civic finances. The building permits again exhibit a marked decline, and there is certain to be a large decrease when the year's figures are made up. Brick is a slow market even at the reduced quotations now in force, while lime, plaster, crushed stone, cement and other commodities are dull. So far the steps taken by the Builders' Exchange to secure the co-operation of masters and men in accepting lower prices and wages have resulted in nothing tangible, the men, through the unions, having taken up a determined attitude in opposition to a smaller scale. Mr. Cottingham, the president of the Sherwin-Williams Company of Canada, spoke in a very optimistic way at the annual meeting of the company. There was, he said, a decrease in the sales of paint during the past year owing to the smaller requirements of manufacturers and railroads, but the country orders had kept up. The outlook was bright, and they looked for an all-round improvement. As a result of a visit to the West, Mr. C. C. Ballantyne, the vice-president, expects better business from the prairie provinces. The iron and steel sections are very quiet, and there is no immediate prospect of any greater demand. Two or three companies are, however, benefitting from the war, having received considerable contracts for the manufacture of shells. Linseed oil is firmer, with a rise of 2c. in boiled and raw descriptions. There is little doing in the lumber trade, and one firm who has been hard hit by several failures declares it does not want any business relations except with those who are absolutely first-class financially. Owing to the difficulty of securing space, the overseas export business has been at a standstill for three weeks.

At Winnipeg conditions have not changed much since last month. Trade in a few lines has improved during the month, while in other lines it remains very quiet. Construction work is closing down owing to the arrival of the cold weather. A number of large blocks are being rushed to completion before the extreme weather forbids further progress. The city has under consideration a proposal to spend $466,000 on trunk sewer construction. It is generally expected that this will be carried by an early vote of the city council. If the scheme receives their sanction it will provide work for 1,000 men for 150 days. So far as building is concerned, the permits continue to show a falling off as compared with the corresponding period of last year. The sentiments of our business men in regard to the effects of the war, have not been over bright, but there now appears to be a more confident feeling that trade conditions are not so bad as at first supposed. Many of our manufacturers are receiving orders which before the war were being given to other countries. The effect of this will in time affect the local market for building materials. The Dominion Government is continuing its policy of proceeding with all its public works. This fact is helping to improve the market. The banks and loan companies still remain very stringent regarding loans. Money, however, seems to be more plentiful than last month. Various supply houses state that collections are excellent.

Regarding market conditions and prices. There is a brisk demand for cement. The price in 5-bbl. lots remains as quoted but there is a decrease of 10 cents in the price of car load lots, the new price being $2.20. Business continues to be brisk in lime, and prices remain unchanged. There is a special demand for Kelly Island lime at $2.10 per 200 pounds. Business is very quiet in the brick field. There are a few sales, but in all grades everything is very dull. There are no changes in the prices which were quoted last month. Trade is only fair in crushed stone, sand and gravel. Prices remain as quoted. In every line of the lumber business, trade continues to be very quiet. There are signs that an improvement may be expected at any time now. Prices are unchanged.

There is no change in the state of the steel and iron trade, everything is very quiet. It is expected that there will be no material change in this line of business until the spring. Prices remain firm. The demand for sewer pipe continues to be very dull. Prices are as quoted. Good business is being done in hard wall plaster, plaster of Paris, and Hammer Brand, the prices of which remain as quoted. Trade continues to be very bright in paints and oils. The prices have again been subject to slight revision. Boiled linseed oil, in barrels, which was quoted at 74 cents per gallon last month is now only 69 cents per gallon, while raw linseed oil which was quoted at 71 cents per gallon, is now 66 cents per gallon. The remaining prices hold firm.

A special feature of the market prices this week was the abrupt advance in window glass. The prices which have gone into effect range from 75c. to $1.00 per 100-foot box. It applied on all sizes, both single and double. The cause of this rise is attributed to the situation in Belgium brought about by the war. All the supply houses report an enormous demand for this material.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff. $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $55 per M. Lots over 100,000, $50.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 66c. per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

(Continued on page)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks:
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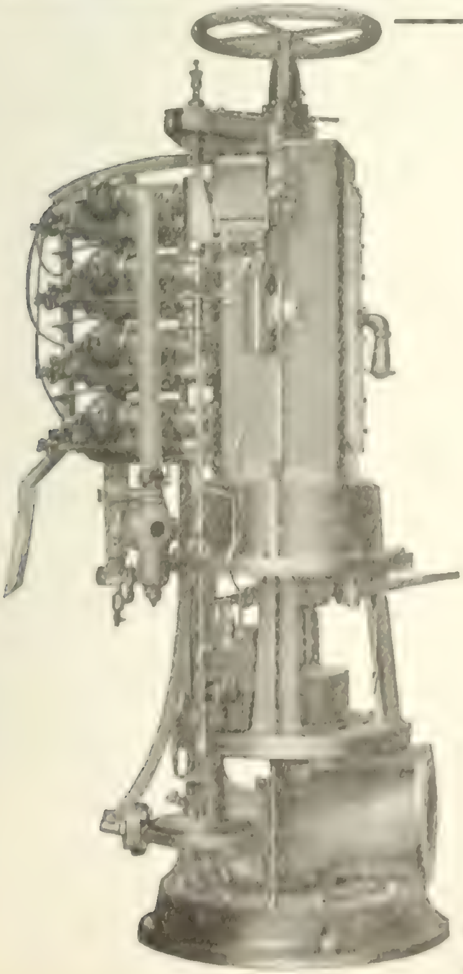

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The Problem of Increased Water Supply from Deep Wells Permanently Solved

Hill-Tripp Deep Well Pumps may be arranged for Gas Engine, Electric Motor or Belt Drive.

The faults and defects of other designs have been entirely overcome.

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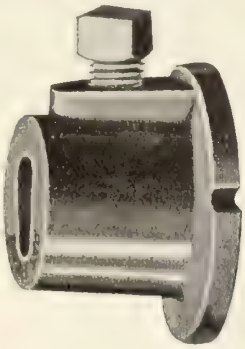
MONTREAL, and in the KING EDWARD HOTEL

Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

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Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

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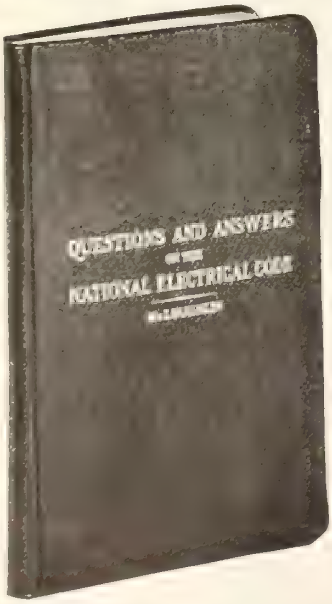
You Can Interpret the Code Instantly with McLoughlin's



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Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

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Bare and Insulated Electrical Wires for all purposes.

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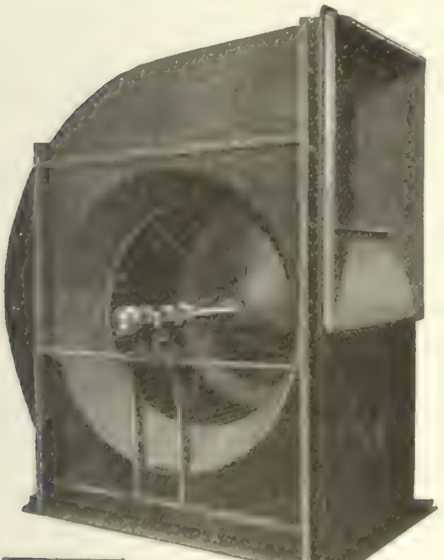

Single Inlet, Top Horizontal Discharge Sirocco Fans Built in sizes with capacities of 75 C.F.M. to 1,000,000 C.F.M. in all angles of discharge and arranged for either pulley, motor, engine or turbine drive.

Greatest in Capacity—and Efficiency

Genuine "Sirocco" Patented
TRADE MARK.

Multi-Blade Fans and Blowers
—MADE IN CANADA—

Exhaustive tests conducted by our Experimental Department and by competent, unprejudiced engineers in competitive trials, has proven conclusively the "Sirocco" to be the most efficient commercial fan in the world. It occupies less space, and requires considerably less expenditure of power for a given duty than any other type of fan. Proper design and construction are the basis of the superiority of the "Sirocco" Fan, and make it the ultimate standard of excellence everywhere.

Learn concerning its principle of construction and why it is the best.

"Sirocco" Catalogue No. 201, valuable to Engineers, Architects and Contractors.

Sales Engineers
[illegible]
[illegible] Bldg.,
Montreal

[illegible] POWERS
[illegible] Victoria St.,
Toronto

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

Sales Engineers
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No. 3 Plain Sheave
Dumb Waiter
50 to 150 lbs. capacity

Residence and Apartment

DUMBWAITERS

"Chelsea" Dumbwaiters are quickly and easily operated, practically noiseless and run without friction or jar.

Write our agents for information.

Chelsea Elevator Co., New York

Agents

Hardware Co. of Toronto
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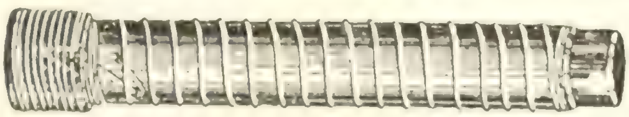

Continuous and Machine Banded Wood Stave

WATER PIPE

Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
Write for Catalogue
Full Particulars and Estimates Furnished

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

[illegible] from page 68

Brick—No. 1 pressed, $17; No. 2 pressed, $15; [illegible], $20, buff rustic, $20; red [illegible], $14, buff [illegible], $21; buff (rough), [illegible], $8.50, C. P. R. 50c extra except [illegible] Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, [illegible] $15, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up. $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x [illegible], 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double [illegible] trap and hand hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.75 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c [illegible] Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assiniboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1 in., $2.90; ¼-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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NEW BOOKLET OF COMPLETE INFORMATION FREE
(MENTION THIS PAPER) M. 3713

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "Contract Record" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1888

Contract Record and Engineering Review

347 Adelaide Street West, Toronto

Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, Sackville, N. B.

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Turbine Pumps

Electric and Steam

Water Works
Factory and
Fire Services

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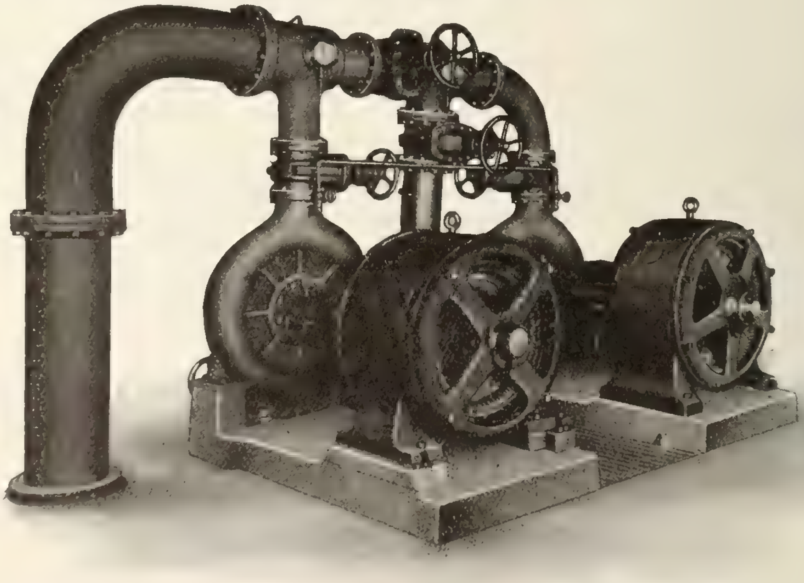
Pumps

Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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CALEDONIAN IRON WORKS CO., LIMITED

Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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and other similar works

Manufactured by
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Towers and Tanks for all purposes.

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Windmills

Water supply outfits of every description.
CORRESPONDENCE SOLICITED

"Metallic"

Think for a moment! Then answer this question:—How many times could you have clinched the contract for interior decoration—if

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CEILINGS and WALLS

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THE "METALLIC" LINE INCLUDES
Galvanized or Copper Cornices, Skylights, Steel Shingles, Steel Ceilings and Walls, Ventilators, Steel Siding, Corrugated Iron, "Hayes" Patent Steel Lath, etc.

Catalogues and Prices sent promptly on request

THE METALLIC ROOFING CO.
OF CANADA LIMITED,
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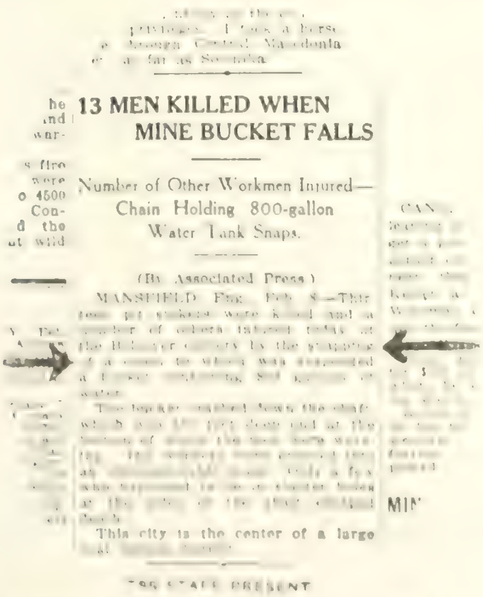

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Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

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This city is the center of a large

Save money as well as loss of life and property by using a Canadian made electric-welded chain.

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1—Class B 1 Rand Duplex steam driven Air Compressor, duplex steam and air cylinders 8 x 12, Automatic oil feed and self regulating governor, heavy fly wheel
1—8 x 12 C. C. Engine with Pickering governor.
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1—Rand Air Hoist Class "B" 4-in. x 4-ft. lift.
1—Steel Ore Bucket, straight sides, 37 x 37, ring and pin fastening (new).
1—Steel Ore Bucket, taper sides, 8 cu. ft., ring and pin fastening (new).
1—6-ply Monarch Rubber Belt, 20-in. x 60-ft.
1—7 x 12 D.C. S.D. High Speed Hoist (Drum 36 x 36).
Several Stratton steam separators for pipes, 1-in. to 5-in. (new).

All in good working order and open to inspection at our plant.

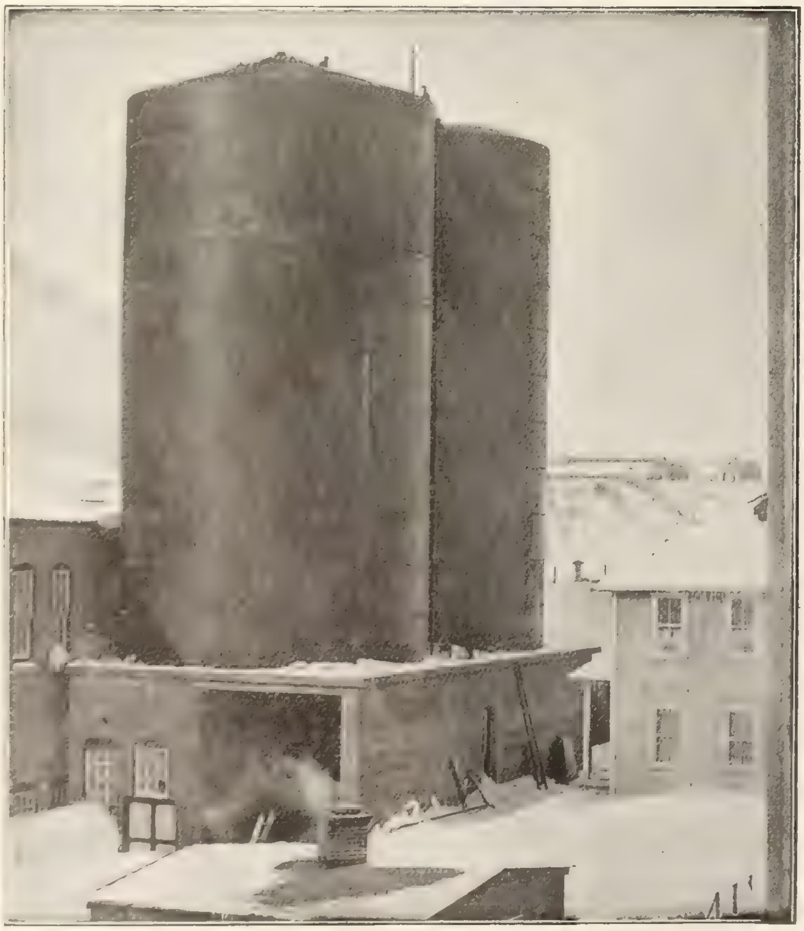
Marsh & Henthorn, Limited
BELLEVILLE, ONT.
Makers, Hoisting Machinery

"Hammer Brand"
Hard Wall Plaster

HARD-WALL PLASTER
HAMMER
BRAND
HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada



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to support them.

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Will eliminate two-thirds of your joint trouble. How? By eliminating two-thirds of your joints with their bolts, gaskets and liability to leak. An **Interlock Neck** is much lighter than a cast iron or steel fitting, although "as strong as the pipe."

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Drifting Sand Filters

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Designs and estimates furnished on application.

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Water Filters	Refrigerating Machinery
1,000 to 1,000,000 Gallons a Day	1/4 to 60 Ton Daily Capacity

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4 Gallons to 5,000 Gallons a Day

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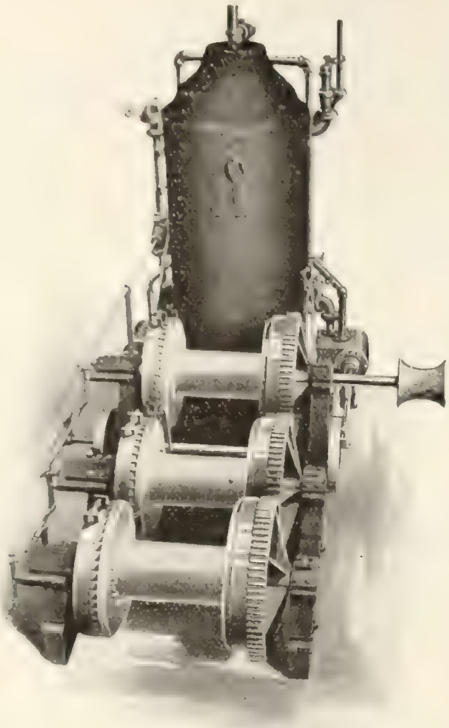

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Has always been Made in Canada

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A. R. WILLIAMS MACHINERY CO., Winnipeg

THE DRILLING OF ROCK

IF you figure the price of a drill on the footage it will give and the length of time it will last, on its power consumption, then the McKiernan-Terry

Busy Bee Hammer Drills

are the cheapest you can buy. You will find that they will give you real economy no matter what the job. Their uses are numberless. Work in wet or dry rock—anywhere. There's a minimum expense for labor, power and repairs.

Use F. J. A. B. Drill Steel, unequalled in quality, carried in stock at our warehouse.

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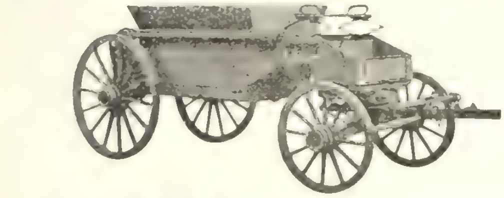

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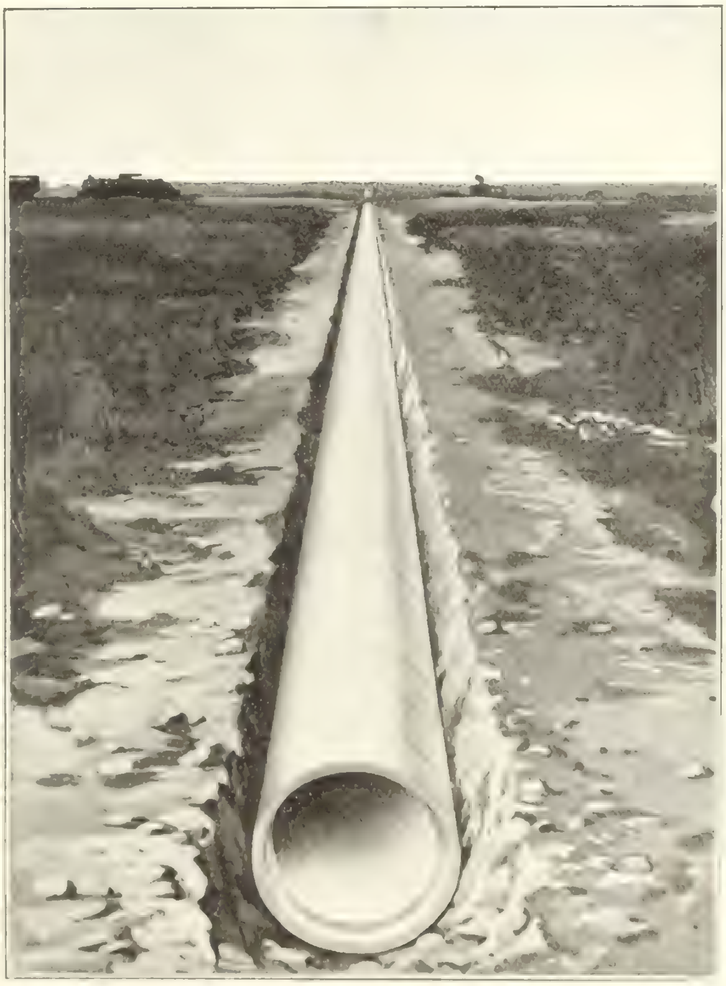

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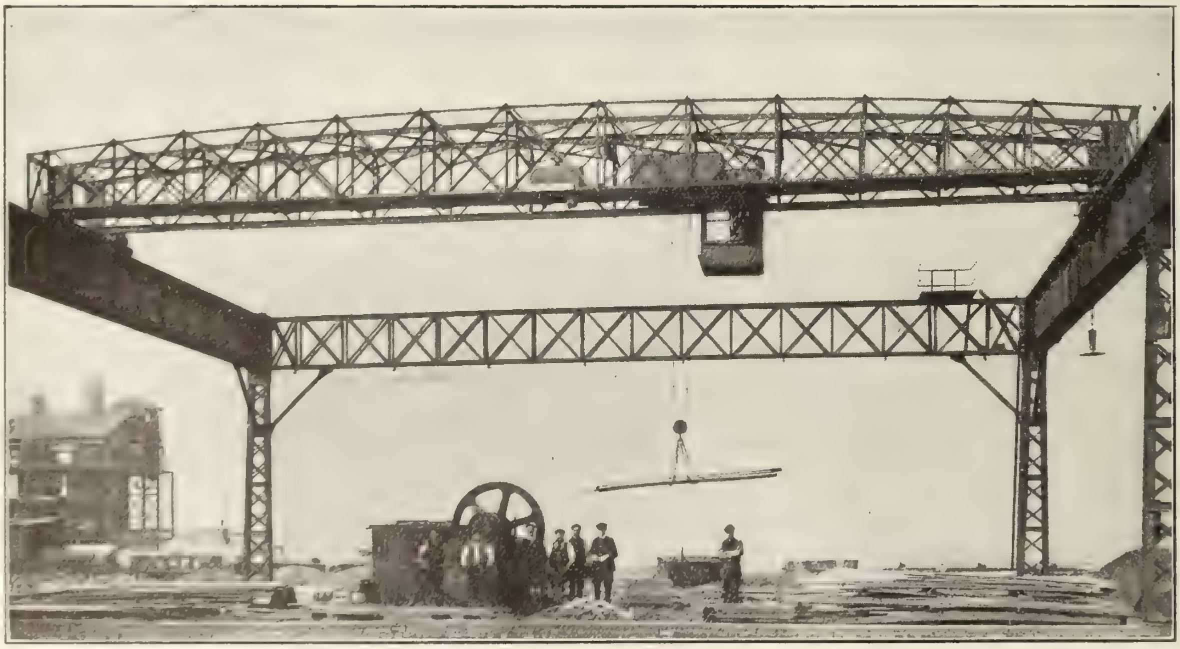

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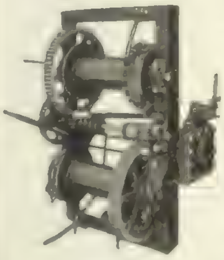
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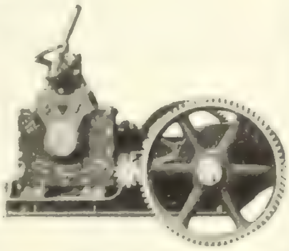
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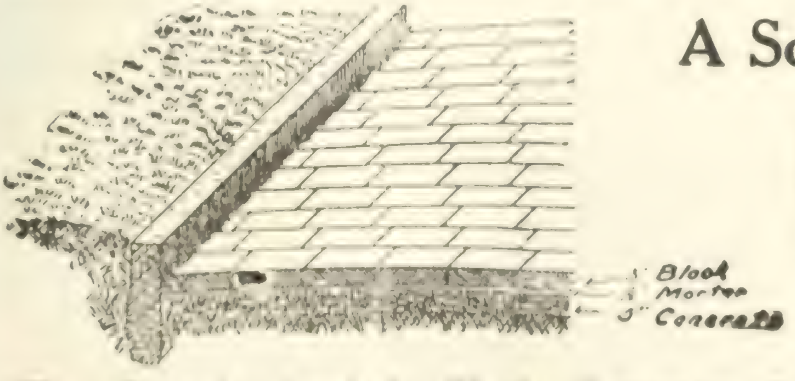

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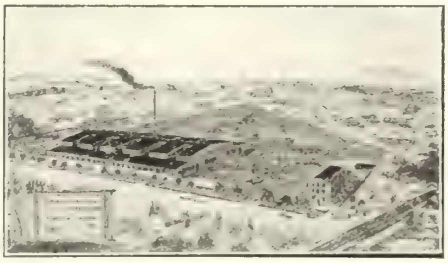

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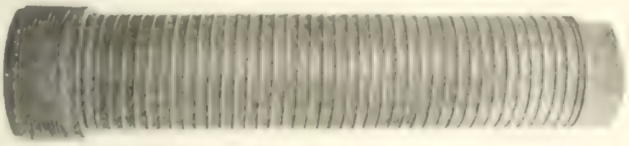

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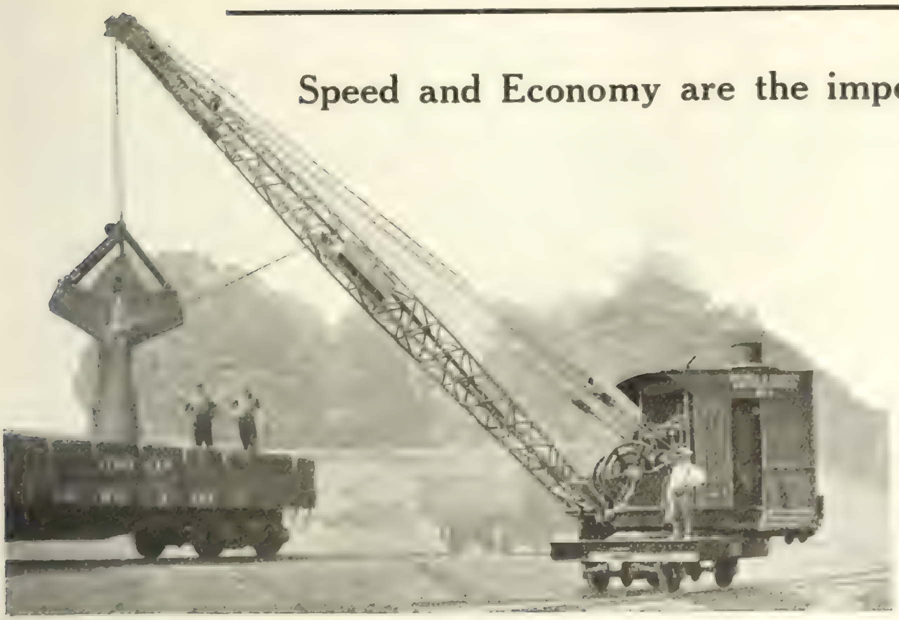

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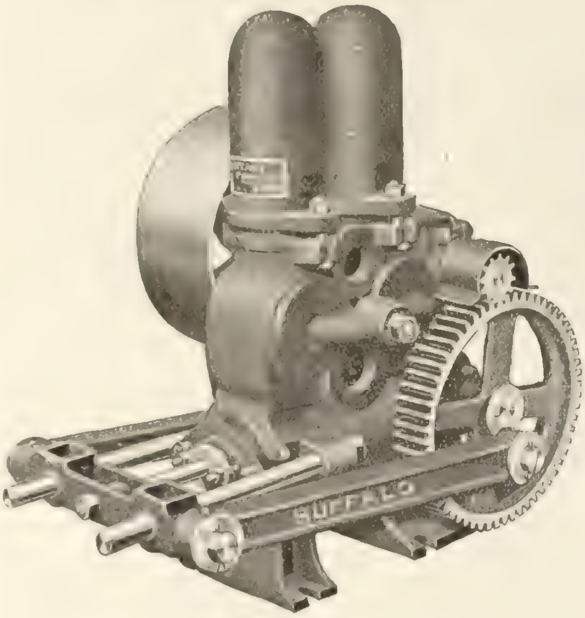

Fig. 401

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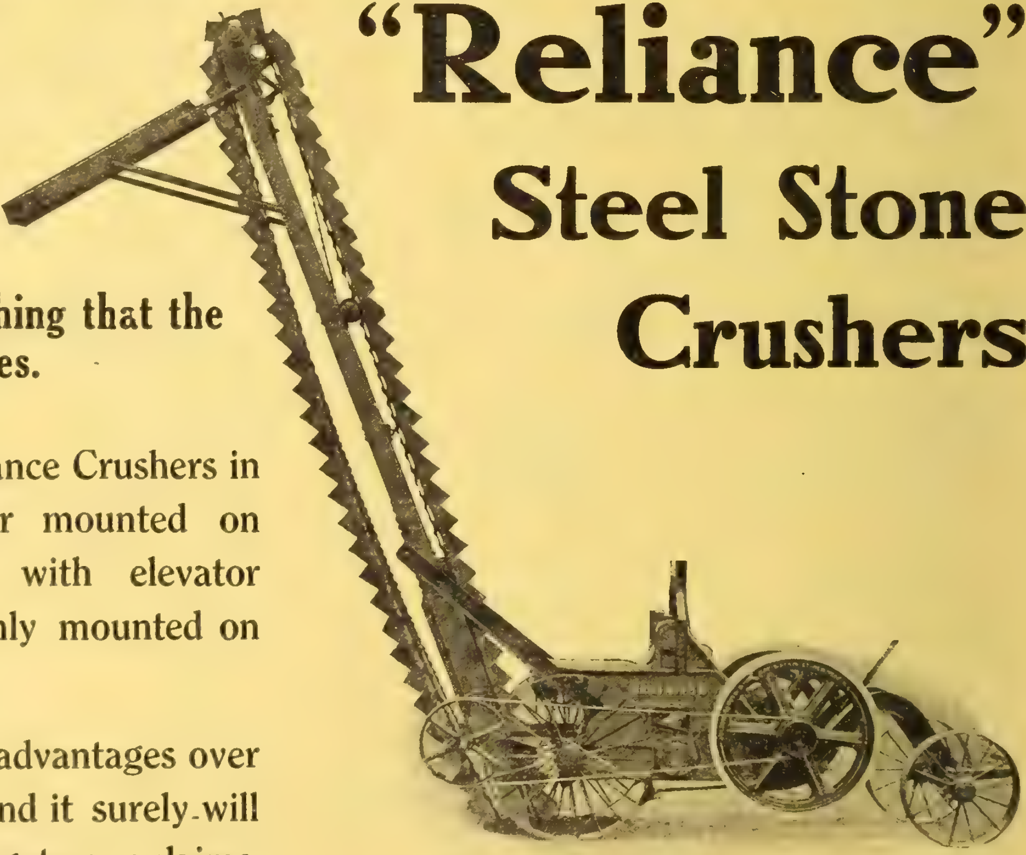

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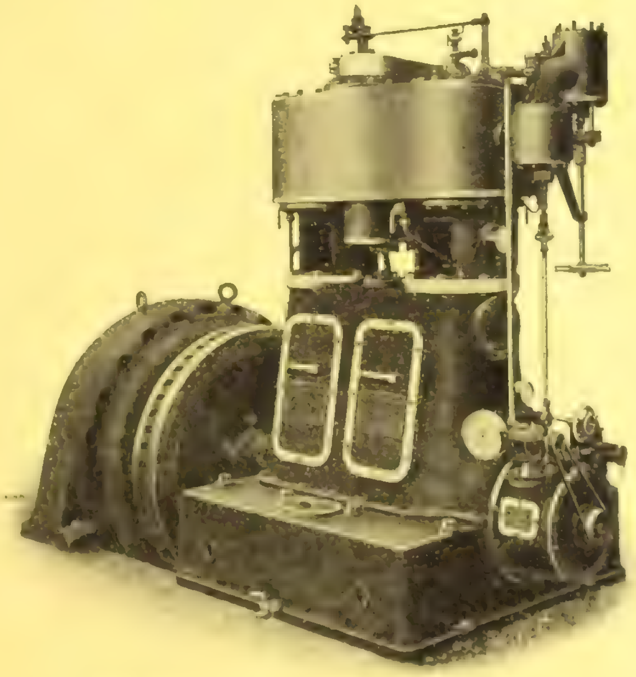

570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

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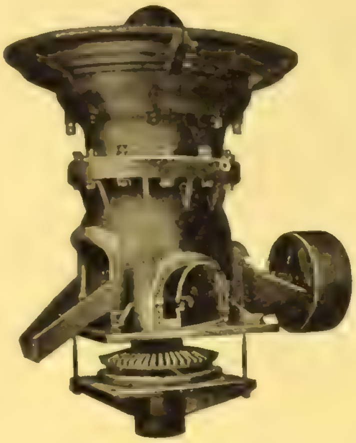


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

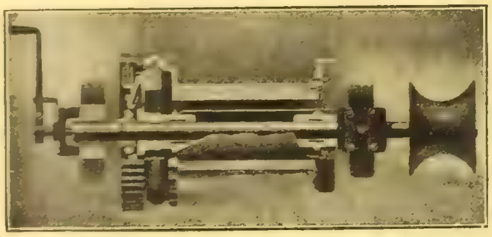
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

AMERICAN HOIST & DERRICK CO.
ST. PAUL, MINN.

SOLD BY

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Gorman, Clancy & Grindley, Edmonton, Alta., and Calgary, Alta.

Stuart Machinery Co., Limited, Winnipeg, Man.
Vancouver Machinery Depot, Limited, Vancouver, B.C.

28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**
Montreal, P. Q.

A New Year's Resolution For You

"RESOLVED that, during 1915 and thereafter I will give preference, in my purchases of rubber goods and all other material, to such as are made in Canada."

So far as rubber goods are concerned you run no risk in making this patriotic resolution, as we manufacture a complete line and the price, quality and style are right.

When in the market for tires, hose, belting, packing, etc., let us show you what we can do.

It is our desire to serve you.

**Canadian Consolidated
Rubber Company, Limited**
Montreal, P. Q.

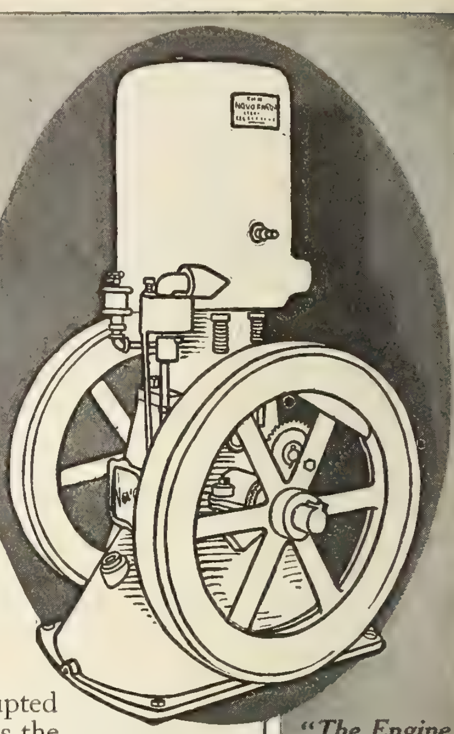
28 "Service" Branches
Throughout Canada

NOVO

REG. U.S. PAT. OFF.

ENGINES AND OUTFITS

NO TANK
NO FAN
NO FREEZING
TROUBLE



"The Engine for Every Purpose"

For the Man Who Cannot Afford to Let the Wheels Stop Turning

For the man who *must* have uninterrupted power at reasonable cost—the Novo Engine is the best answer to his power problem. The Novo Engine has proved that it will stand up under the hard, gruelling test of contract work. Furthermore, Novo power has proved itself cheaper than steam or electricity in fuel consumption per horse power developed as well as in other costs of operation, in maintenance and in capital invested.

The light weight of the Novo and the small space it occupies, its simplicity and easy portability are advantages no power user should overlook. Its frost-proo cooling system, automatic fuel control, compactness and power, fit it for work of every sort—make it truly "The Engine for Every Purpose."

Its adaptability for portable or stationary uses and outdoor service is practically unlimited.

The Novo Engine is built four-cycle to make its fuel consumption low, to last longer, to be adaptable to speed and load variations met with in rough service.

The Novo is made vertical to be lighter, more readily portable and to occupy less floor space, and to enable it to be more easily lubricated.

The Novo hopper-cooling system is designed in its peculiar form to make the engine proof against damage from freezing, to make unnecessary the draining off of the cooling water in winter, to make the engine run with greater efficiency and to prevent overheating.

Let us send you "Reliable Power," the Novo Book

one of the most valuable engine books ever published for the use of the man who wants to know how to get cheaper and better power. Sent free if requested on your business letterhead.

Novo Outfits

Novo Hoists—Made in three general types—non-reversible, reversible and double drum—and in ten sizes from 600 to 4,500 lbs. lifting capacity They are used in building construction, ice handling, logging, car hauling, back filling of sewers, freight handling and similar work.

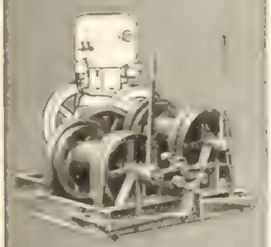
The Novo Double Drum Hoist is the newest addition to the Novo line, equipped with 10, 12 and 15 H.P. engines. See Fig. 14120.

Novo Centrifugal Pumps—Made in three types—chain drive, direct-connected and belt-driven. For draining excavations and for irrigation. Mounted on all steel trucks, channel-steel or solid iron bases.

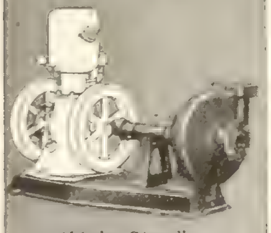
Novo Suction and Force Pumps are made in numerous styles and sizes, to fit all requirements, with capacities of from 300 to 10,000 gallons per hour. They are used for farm and home water-supply systems, for factories, filling railway tanks and city water service. Mounted on channel-steel or cast-iron bases, according to character of pump.

MUSSENS LIMITED

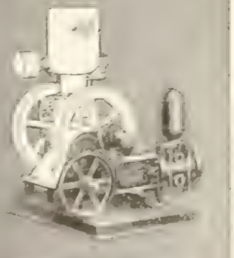
Montreal, Toronto, Quebec,
Winnipeg, Calgary, Vancouver,
St, Johns, N.B., Halifax, Cobalt



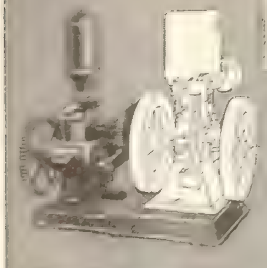
Novo Double Drum Hoist Fig. 14120



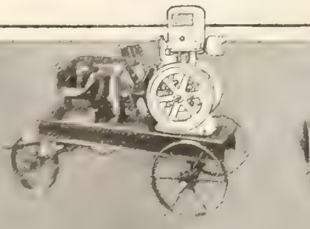
"Little Giant" Centrifugal Pump Fig. 1478



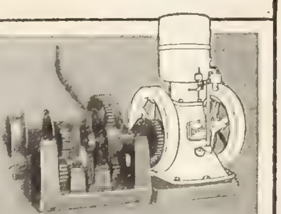
Novo High-Pressure Pump Fig. 1454



Novo Suction and Force Pump Fig. 1401



Novo Trench Pump Fig. 1457



Novo Reversible Hoisting Rig Fig. 1455

Do you make Machinery

that is or may be run by gasoline power?

Do you sell a completely equipped cement mixer, saw rig, pumping outfit, etc.?

Then consider the immense sales advantage your product will have if run by a Novo Engine; if equipped with an engine that is, today, operating over 60% of the best cement mixers in the world.

First—The advantage of an engine that has proved its absolute reliability; that removes "engine trouble" as a factor in selling your outfit.

Second—Figure out the added prestige that a combination of two good machines must produce.

Third—Realize the profit to be gained from the advertising that has made the Novo Engine so well known. It gives you a sales argument that parallels that of the automobile manufacturer in featuring a standardized axle, carburetor or self-starter. Let us get together for our mutual benefit.

FROM THE

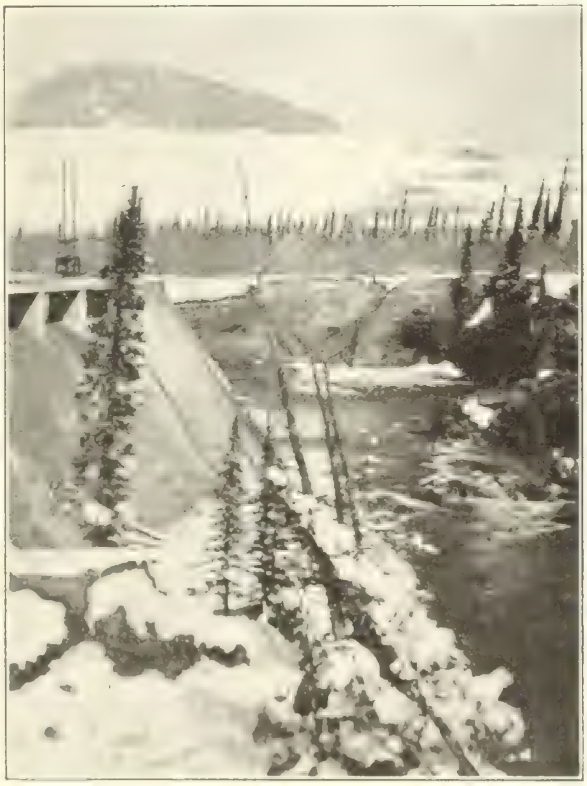
ATLANTIC TO THE PACIFIC

You will find **HOLMAN PISTON STEEL ROCK DRILLS** operating on all conditions of rock work.

Whether on

Small Contracts,
Large Contracts,
Prospects,
Small Mines,
Large Mines,

the Holman Steel Rock Drill gives satisfaction owing to its low air consumption, low maintenance cost, low steel cost and high speed of drilling.



New dam of Calgary Power Co., where Holmans were used exclusively.

Allow us to demonstrate to you personally the advantage of using Holman Piston Drills on your work.

THE DEMONSTRATION IS AT OUR EXPENSE

Write us for further particulars.

Full Stock carried at all our warehouses.

THE DRILL YOU WILL FINALLY BUY.

Sole Canadian Sale Agents

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COBALT, Opp. Right of Way Mine
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CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

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Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

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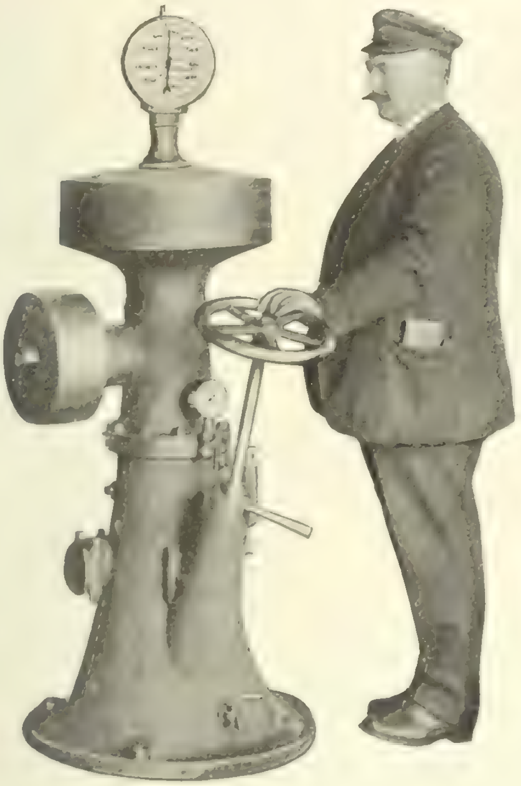

MADE IN
CANADA

Water Turbines
Centrifugal Pumps

*Patronize Home Industry and let
us Quote on Your Requirements*

**Boving & Co. of Canada
Limited**

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Moose Jaw, Sask.

Head Office
164 Bay St.
TORONTO

London Bldgs.
Vancouver, B. C.

Factory, Lindsay, Ontario

Mexico City Wellington Cairo London, Eng. Tokyo Johannesburg Rio De Janeiro

***Prisms May Come and
Prisms May Go
But Luxfer Stays on Forever***

WHEN the Luxfer Prism was first manufactured some Seventeen years ago it had many imitators and a few competitors. They have all died off and "Luxfer" is still the one best prism to solve daylighting problems for factories, stores, warehouses and offices.

Specify "Luxfer" the first and best prism and you will get the daylight you are after.

Luxfer Prism Company, Limited
100 King St. West, Toronto

The Event of the Year For Road Builders

The Fifth American Good Roads Congress will be held as the Eleventh Annual Convention of the American Road Builders' Association, International Amphitheatre, Chicago, December 14-18, 1914. This great annual convention and congress will bring together the highway officials, engineers and contractors from every part of the United States and Canada. It will be the event of the year for Road Builders. All of the phases of road and paving construction will be discussed by men who are recognized as the leading experts in the science and art of highway improvement.

The Sixth Annual Good Roads Show, which will be held in conjunction with this congress, will consist of exhibits of the machinery, materials and methods used in the construction and maintenance of country roads and city pavements. These exhibits will constitute the largest display of the kind ever held in the world. In addition to the commercial exhibits there will be educational exhibits from the states, cities, engineering schools and universities. This exposition will afford the best opportunity for study and comparison that has ever been presented.

A unique feature of the show will be a model roadway constructed in the arena of the International Amphitheatre. This roadway will be of standard construction, twenty feet wide and some four hundred feet long. It will be made in sections, each section constructed of different material and by a different method.

Every highway official, engineer and contractor is cordially invited to be present at this convention. Make up your mind today to attend and participate in the proceedings. The information you will secure and ideas you will get will pay you many times over in your work during the coming year.

Write for full information concerning programme,
hotels, train service and reduced rates.

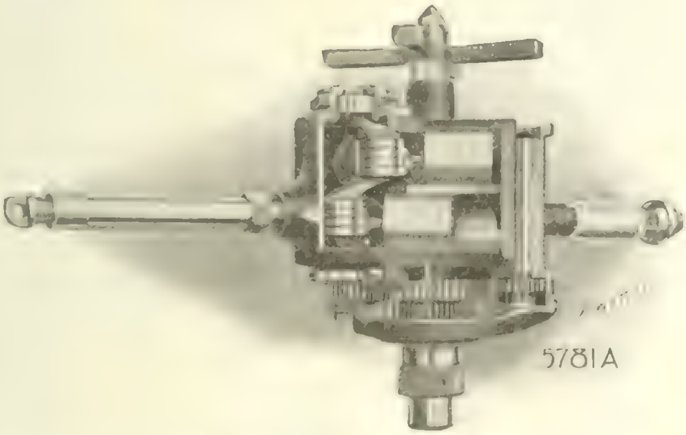
American Road Builders' Association

150 Nassau Street New York, N. Y.

Hotel Convention Headquarters, The La Salle, Chicago

For Drilling, Tapping and Reaming Metals; For Driving Studs, Flue Rolling and for Wood Boring

USE "LITTLE DAVID" PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

You'll find "LITTLE DAVID" Drills the most satisfactory tools you have ever used.

CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE QUE

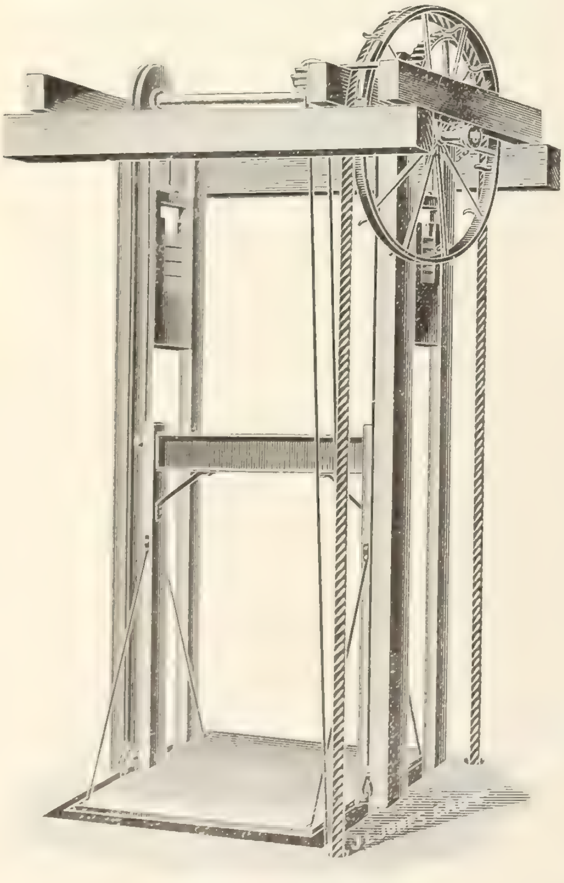
Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver

TOOL ROOM PARTITIONS

Machinery Guards
Window Guards
and
Wire Work of
Every Description
Wire Rope
Rope Fittings

Manufactured by

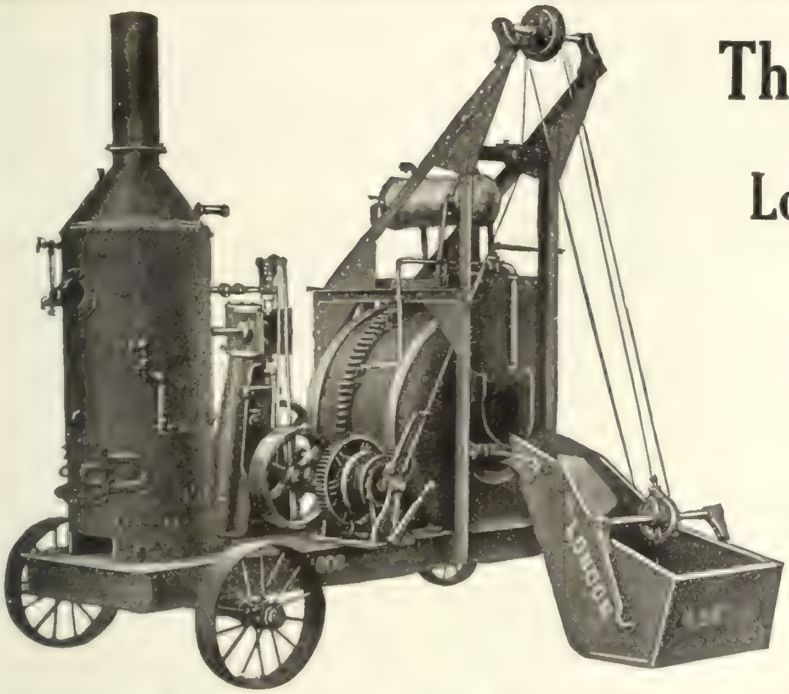
The B. Greening Wire Company, Limited
HAMILTON, ONT. MONTREAL, QUE.



Turnbull Elevators

Passenger
Freight
Hand Power
Dumb Waiters

The Turnbull Elevator Mfg. Co.
Toronto, Ont.



The European Crisis

does not affect the delivery of

London Concrete Mixers

Our policy is

"Business as Usual"

The London Concrete Mixer is the equal in all respects of any Mixer manufactured outside Canada. There are more than 1,200 London Mixers in use in Canada—also many in Foreign Lands. All steel construction and built like a Dreadnaught. Guaranteed for life. Made in twenty-three sizes and fitted with any equipment.

SUPPORT HOME INDUSTRIES

We Are the Largest Manufacturers of Concrete Machinery in Canada.

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory: Cabell St. and Kitchener Ave., LONDON, ONT.

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CALGARY—622 9th Ave West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

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Montreal, P. Q.—Foss & Hill Machinery Co.
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Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

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High grade workmanship and design; special attention being paid to economy of fuel and maintenance. Fifty years' experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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- Sheldons Limited

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- Canadian Sirocco Company
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- McDougall Caledonian Iron Wks.
- Mussens Limited
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- Dominion Engineering & Inspection Company
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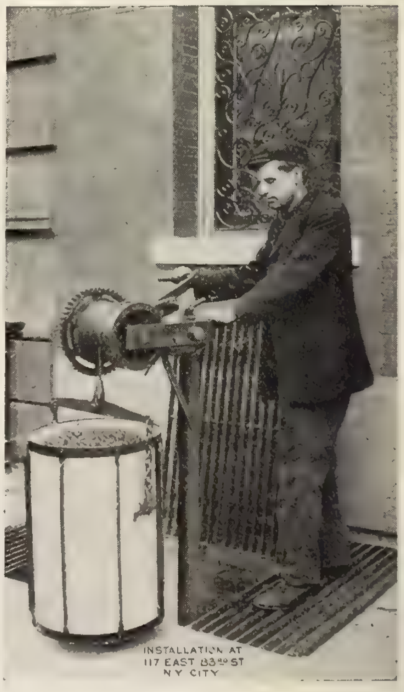

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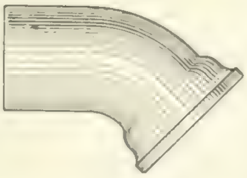

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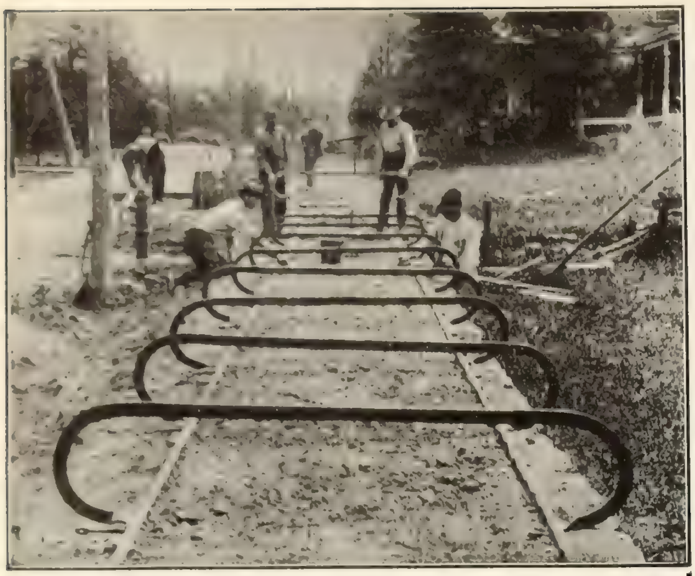

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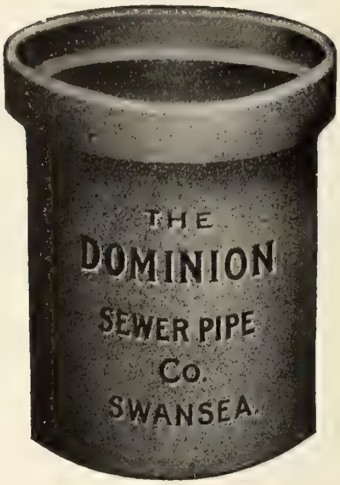

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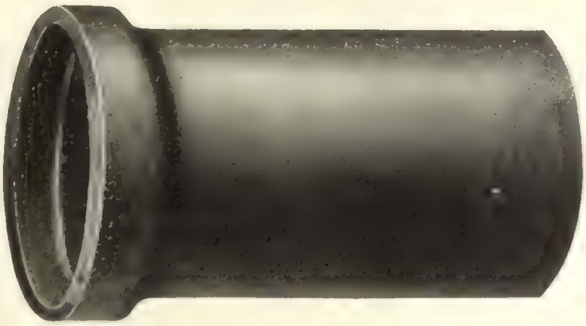

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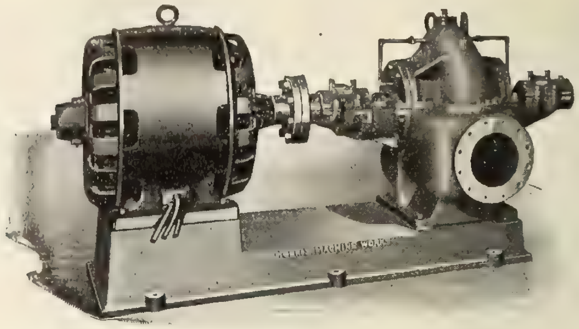

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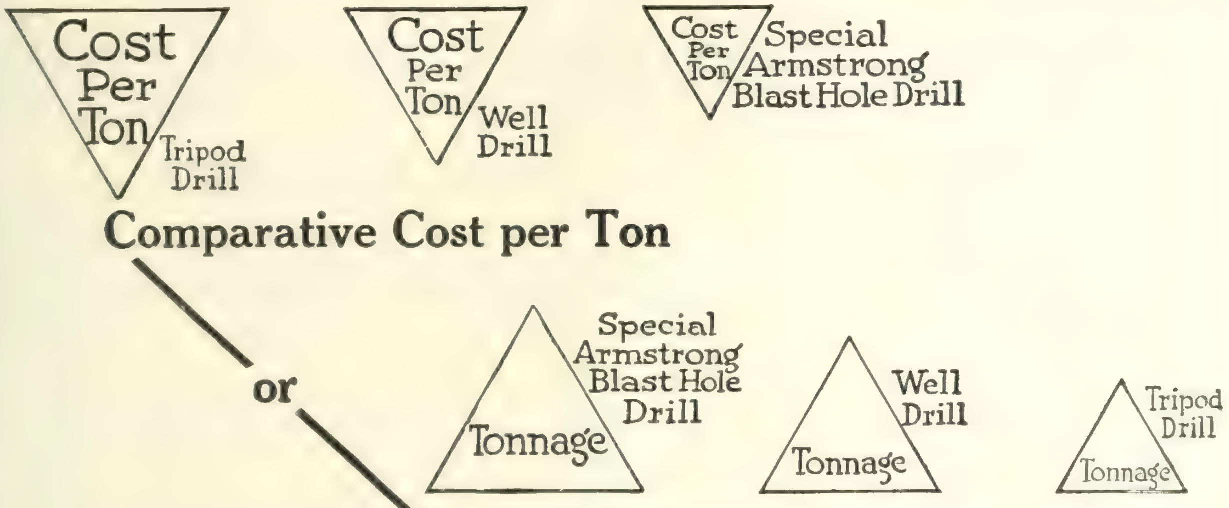

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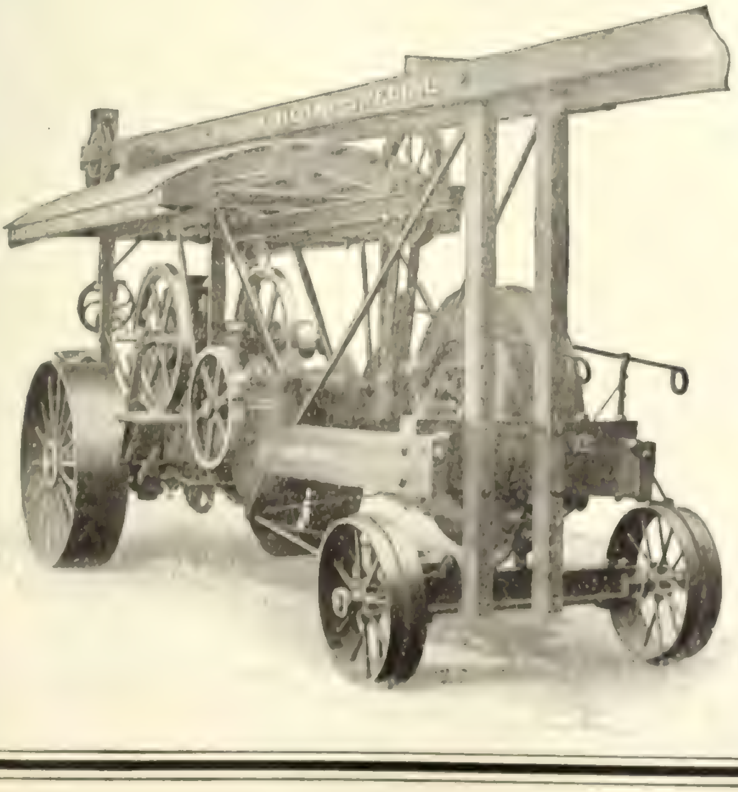

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[illegible]

[illegible]

[illegible] time).

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7—We will supply asphalt having the proper penetration for your needs.
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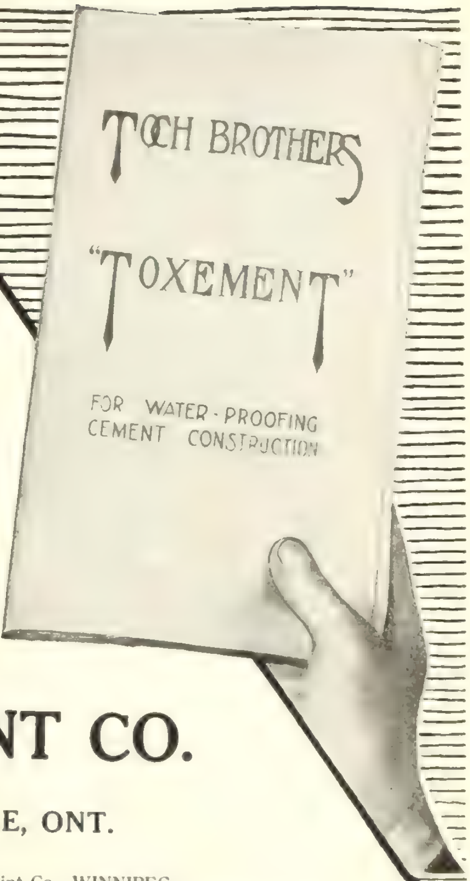

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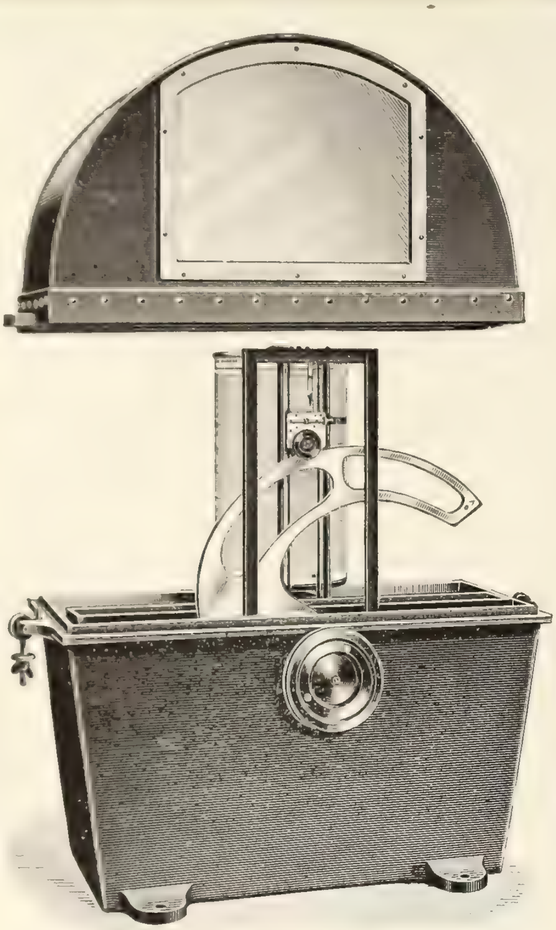

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"MADE IN CANADA"

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Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship, to any made elsewhere.

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of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

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"BRADFORD REDS" is the appropriate name given to our smooth brick, which surpass all others for facing fine residences, public buildings, and for building beautiful fireplaces.

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We also make fireproofing, hollow brick and hollow block.

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"The Red Brick People"
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JM Waterproofing and Mastic

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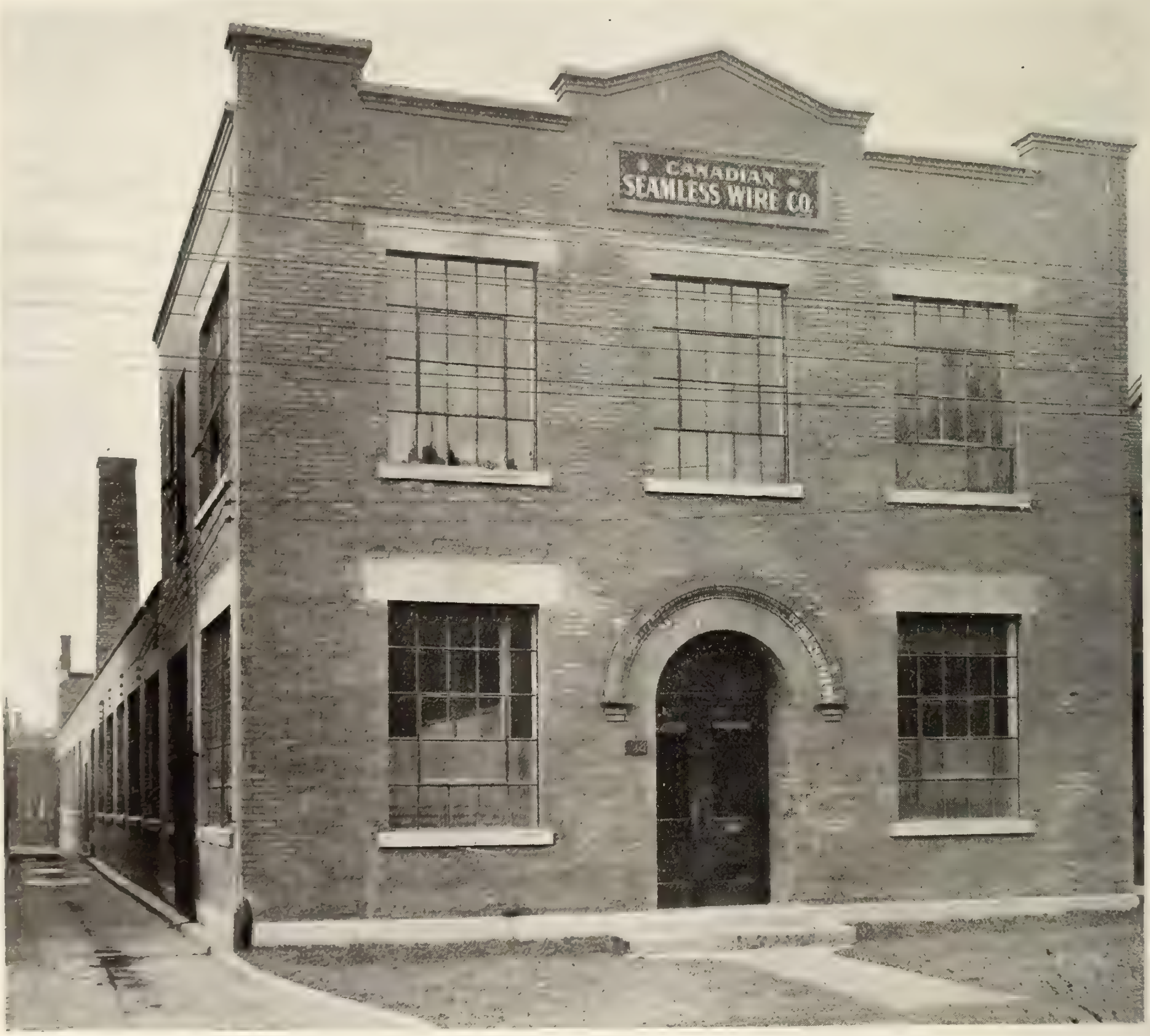

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The series of tests which led to the determination that all Herringbone Lath should hereafter be made from copper alloy showed also that there was a wide variation in the rate of corrosion of the different brands of hard wall plaster. When these plasters were arranged in a table in the order of their corrosiveness, the most vigorous at the top, it was found that they were also arranged inversely in the order indicated by their content of hydrated lime, the plaster containing the least lime at the bottom.

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The Nozzle Man

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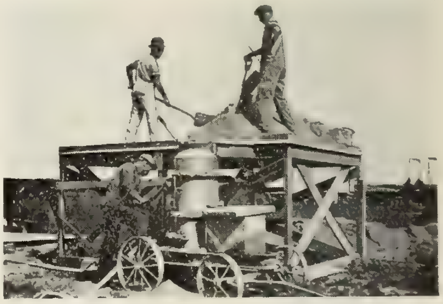
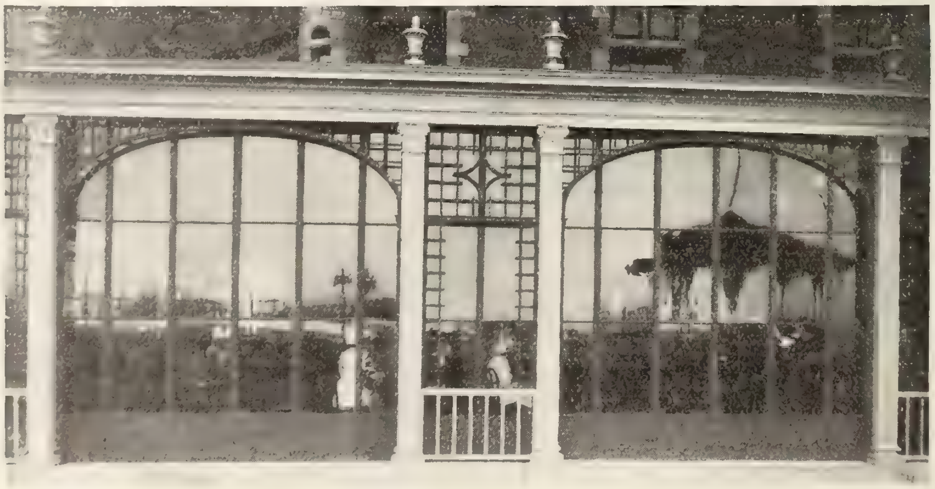


The Cement Gun

Architectural Bronze and Iron



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Contract signed April 20th, 1914, ornamental iron furnished and erected complete on June 1st.

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ESTABLISHED 1886

Contract Record and Engineering Review

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The Clay Products Industry and Its Approaching Convention

IT was well written by Mr. John McLeish, Chief of the Division of Mineral Resources and Statistics, Ottawa, in a special number of this journal some time ago: "The utilization of the mineral and material products of the earth in our present scheme of existence may be said to be of as great importance almost as the production of food or the actual means of sustaining life itself." The quotation may be made aptly in introducing a few thoughts about the forthcoming convention of the Canadian National Clay Products Association, an announcement of which is made elsewhere in this issue.

With clay one of the most abundant of the constructional materials available in this country, and with the status of the industry continually improving as we come to a fuller realization of the wide range and great possibilities of its products, we must take a part in the development of this national association's work and array ourselves on the side of those who are seeking by revised specifications and the interchange of the best manufacturing methods to place the clay-working industry upon a higher plane.

The value of the production of clay products is increasing by leaps and bounds each year and never a season closes but additional evidence comes to hand as to new or improved uses of the material in some form of municipal or building construction. From coast to coast, province by province, brick-making and subsidiary industries are increasing rapidly, both in number and production, and there is not an engineer or contractor in the country who can take the stand—and maintain it—that he is not concerned with the work of striving for higher standards in clay manufacturing.

The first thing to do in approaching the question of higher standards in any industry is to consider the educational facilities at the disposal of those responsible for the product. In the field of clay-working the same principles apply that govern all other spheres of activity. The finest violin in the world would emit nothing but discord were its bow handled by untrained fingers—and it is no less true of clay-working: no matter how many or how vast or how excellent may be our shale deposits, resources and equipment, no matter what the capabilities of the brick or other material, or what chemical and other tests they will survive—if the men in the firing line of the kiln and the plant are ignorant of those fundamentals of testing and chemistry and manufacturing which are essential to the intelligent performance of a workman's or a foreman's part, mediocrity or worse will ensue.

So, then, the question of additional facilities for the clayworker is one of the most important before this comparatively young association and it is a matter which should receive the support of all those who may be in a position to help it forward. The Canadian National Clay Products Association have done creditable work in this field, but the sphere of activity has been localized and the rank and file of the trade throughout the country remain untouched. Much remains—practically all remains—to be done.

What the association wants is more members, more influence and more money, and in the interests of all, whether clayworkers or not, it is to be hoped that these will be forthcoming. In its early days this association experienced the general run of hard times that are the common lot of all beginners, but thanks to the untiring energy of the faithful few the last two in three years have raised the association from a handful of brick and tile makers—with a few machinery men thrown in—to a representative national organization embracing nearly every branch of clayworking manufacture.

Without placing a low estimate upon his predecessors, some of whom were responsible for the hardest of the spade work, we cannot help commending especially the efforts of Mr. Chas. A. Millar, under whose two years' presidency the association has made remarkable progress. When Mr. Millar took the reins of office the affairs of the association had been directed by "men of the old school"—"old-timers"—"boys of the old brigade"—or any other such expression that may be applied to a clique of elderly men who do their best (and a good best) but succeed in restraining every effort at expansion, and remain stationary year after year. Mr. Millar, a comparatively young man, put life and energy into the work and backed it up with the experience which has made him one of the best-informed men in his trade today. The results have been gratifying and it is to be hoped that he may be induced to remain in office.

It promises well for the success of the approaching convention that due regard is to be had to the importance of presenting a programme calculated to be really attractive to the man who takes convention business seriously and hopes to gain from it certain technical information along the particular line in which he is engaged. Latterly there has been an altogether too popular tendency to regard the convention as a holiday jaunt. Nothing is more likely to spell ultimate failure to a trade or technical body than to cater primarily to those whose main purpose in life is to eat, drink and be merry. We all know that a convention without a smoking concert and a banquet is like an egg without salt, but a convention without a properly-organized business session, without carefully-arranged papers and discussions, is beyond criticism and falls into the by-way of disrepute. Doubtless the Executive of the Canadian National Clay Products Association recognize this principle for they already announce addresses by such authorities as Professor Baker, of Queen's University, Dr. McKay, of the Toronto Technical School, and Mr. A. F. Greaves-Walker, ceramic engineer, of Toronto.

The announcement of the meeting comes in good time, allowing a period of preparatory work which should result to good advantage. Clay products men have reached that tide in their affairs which, taken at the flood, leads on to fortune. The "fortune," taken literally, may materialize slowly in view of the depression brought about by the present lamentable war, but applied in the broader and better sense the meaning of the word may soon be realized in a united industry working together for its own advancement and technical attainment, and for the good of all.

* * *

Mr. T. H. Seidl, of Montreal, the Canadian General Manager of Escher Wyss & Company, is a pronounced optimist whose optimism arises out of many encouraging orders and enquiries received since the beginning of the war. Mr. Seidl states that while the war brought about the suspension of a few contracts the average has been maintained by new business. One of the most important orders obtained recently was for two water turbines (each developing 2,300 h.p.) for the Ontario Hydro-electric Power Commission at Eugenia Falls, Ont. The firm has quite a number of smaller contracts on hand and there has been an actual increase in the number of enquiries since the war. This is explained in a measure by the fact that the company's headquarters (Zurich, Switzerland) are located in a neutral country, but in any case it points to business to be obtained. The Montreal office of this firm, of which Mr. Seidl is in charge, has jurisdiction over the business of Canada, Newfoundland and the United States.

* * *

The A. B. Ormsby Company, Limited, Toronto, state that there have been imported from German mills through agents in Montreal and New York large quantities of hot rolled steel sections for use in the building of steel cornices for exterior and interior, steel stair risers and stringers, hand rails for stairs and balconies, steel sections for balustrades, newel posts, steel jambs, steel trims. The company say that they are in a position to substitute for all of this material, steel, cold rolled steel sections and mouldings in any design and in any gauge up to No. 11, which is equal to one-eighth inch in thickness.

* * *

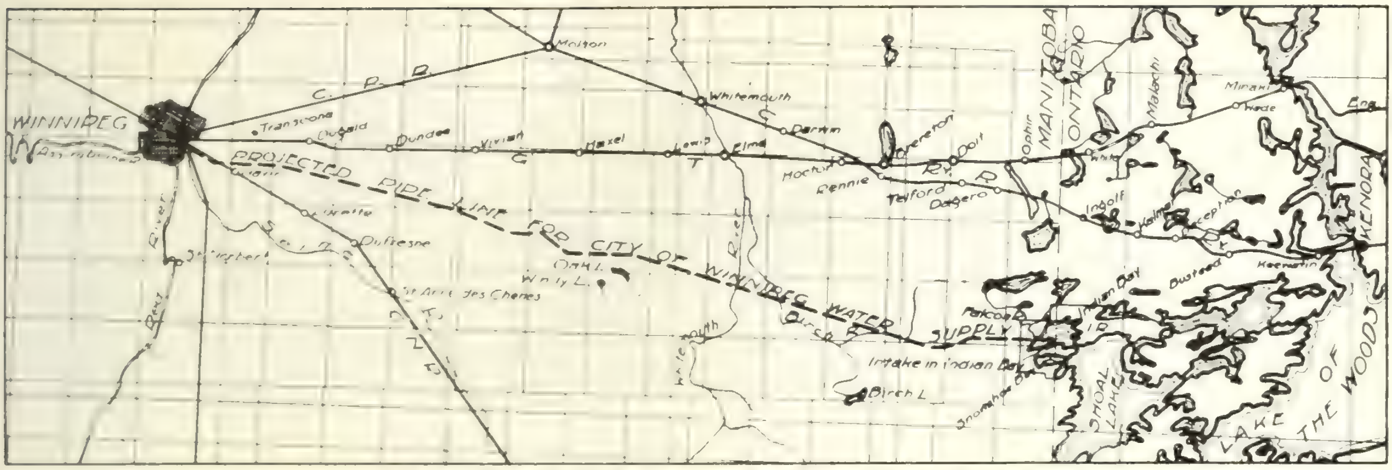
The Australian importations of Portland cement in 1913 were 2,511,828 cwt. (112 lbs.) valued at £264,251, of which Germany supplied £159,969, Belgium £17,131, and Austria £2,168. The cement is packed in paper-lined casks containing about 350 pounds. Under the general tariff the duty is 24 cents per 112 pounds, and the preferential duty to the United Kingdom only is 18 cents per 112 pounds. Particulars concerning the chemical composition of cement used by such large buyers as the Victorian Government railways can be obtained by interested manufacturers upon application to the Department of Trade and Commerce, Ottawa. The Victorian railways invited tenders, returnable in September, for 28,000 casks of cement. Local representation is absolutely necessary for this trade, owing to the short notice of tenders and on account of conditions of delivery. Canadian cement manufacturers, favorably situated for making shipment, should endeavor to obtain a portion of this business. Brands should be registered, and prompt measures taken for the submission of samples to the principal Australian importing centres to ensure Canadian cement being tested and placed upon "the list of manufacturers" acceptable to the various government departments and other large users.

* * *

Wire netting varying in mesh from ⅛ inch to 4 inches, and made of wire from 22 to 16 gauge, is a feature of Australian trade. Much of this netting is for rabbit-proof fencing. The sizes of the rabbit-proof netting in chief demand are:—

Width	Mesh	Gauge	Length
36 inches	1¼ inches	18 and 17	100 yards
42 "	1¼ "	18 17	100 "
36 "	1½ "	18 17	100 "
42 "	1½ "	18 17	100 "
36 "	1⅝ "	18 17	100 "
42 "	1⅝ "	18 17	100 "

Probably the best selling lines are 42 in. x 18 and 17 gauge, and 42 in. x 1½ in. x 1 8and 17 gauge. Rabbit-proof netting is also manufactured in Australia, and if the finished netting for export is not attractive to Canadian manufacturers there is also a market for the wire required by makers of netting within the Commonwealth.



Map of Greater Winnipeg Water District, showing route of pipe line, etc.

The Greater Winnipeg Water Supply from Shoal Lake

Specially contributed by D. McLean

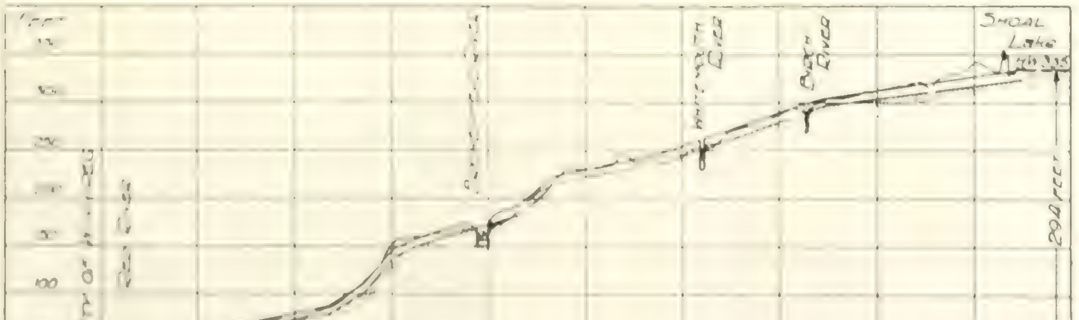
THE Greater Winnipeg Water District, comprising the city of Winnipeg, the city of St. Boniface, and all or portions of five other municipalities surrounding the city of Winnipeg, was created by Act of the Legislative Assembly of Manitoba assented to on February 15th, 1914. Clause No. 5 of this Act states "The objects of the Corporation shall be the supplying of water from any permanent source, whether within or without the province, for the use of the inhabitants of the said District, for all purposes."

Under the powers granted by the Act, the District chose Shoal Lake, a portion of the watershed of the Lake of the Woods, as its source of supply. In order to take advantage of the gross difference in elevation between Shoal Lake and Winnipeg (294 feet), it was decided to construct a gravity system of supply. On October 1st, 1913, a by-law was passed authorizing the expenditure of $13,500,000 for the supply of 85,000,000 Imperial gallons daily.

The main engineering features of the system, which is some 97.2 miles in length, comprise:—(1) a construction railway with 102.4 miles of track, including nine sidings, spurs to gravel pits and yards; (2) a dyke and channel at Indian Bay for the diversion of the Falcon River into Snowshoe Bay; (3) a concrete cut-and-cover aqueduct and works, eighty-five miles in length from the intake, Indian Bay, to a future reservoir site southeast of Transcona; (4) 9.8 miles of 60-in. steel pipe between this reservoir site and the Red River; (5) a tunnel under the Red River; (6) 2.3 miles of forty-eight inch cast iron pipe between the Red River and McPhillip's Street Reservoir.

In order to carry forward this work the following appointments were made after the passing of the by-law: Mr. S. H. Reynolds, C.E., Chairman of Commissioners; Mr. J. H. Ashdown, Commissioner (without remuneration); Mr. James H. Fuertes, Consulting Engineer, and Mr. W. G. Chace, Chief Engineer.

Five survey parties were speedily placed in the field for the location of the aqueduct line and a large office staff was organized for the necessary work on design. The location survey work, which was pushed to completion by the end of February, 1914, included



Profile of aqueduct from Shoal Lake to Winnipeg

Construction railway—Brokenhead River Bridge.

Falcon River dyke, about half completed. Looking from scow to north shore.

some 380 square miles of topography, 362 miles of transit lines, 1,317 miles of levels, 95 miles of precise levels, 11,545 feet of soundings at Indian Bay and 3,897 feet of test boring along the line, with 7,445 feet at Indian Bay.

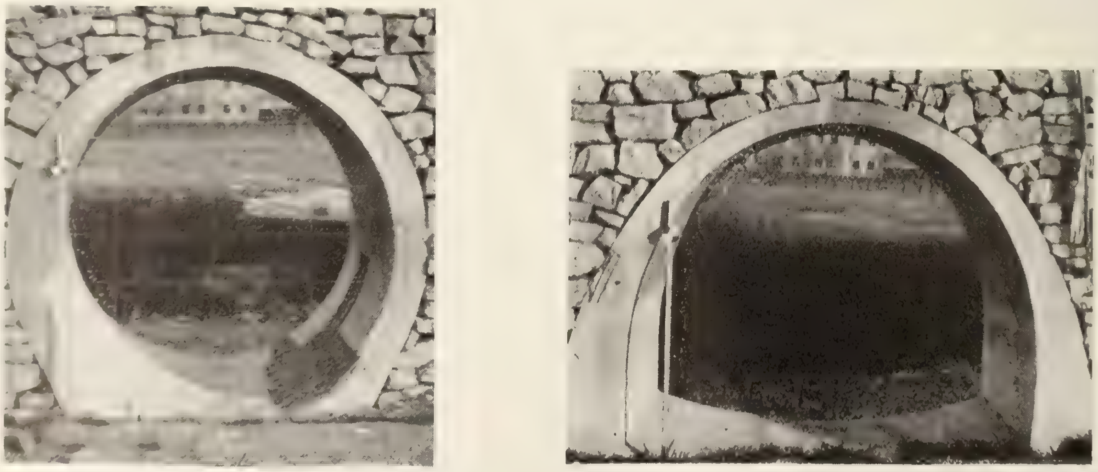
Construction Railway.—The located line of the aqueduct runs south of the Canadian Pacific and National Transcontinental Railways and north of the Canadian Northern Port Arthur line, through an undeveloped section of the country. In order to bring in the supplies and machinery required for the aqueduct construction, it was necessary to build a railroad along the aqueduct right-of-way, This road, which is now in process of construction, is of standard gauge, with 60-lb. rails and substantial road bed. Including yards, spurs to gravel pits and sidings, there will be in all about 102.4 miles of track. The maximum grade is 0.5 feet per 100 feet and the maximum curvature is four degrees. The aqueduct contractors' working tracks will be located between the railway and the trench. It will cost approximately $1,200,000 and it is being built by the Northern Construction Company, of Winnipeg. It will include in its construction the following materials:—9,671 gross tons of 60-lb. steel rails, 65,652 angle bars, 136,315 bolts, 1,158,560 spikes, and 284,580 ties.

The clearing of the right-of-way was done by E. J. Bawlf, of Winnipeg. This work cost $79,360.34 and comprised:—clearing, 2,586 acres; salvage, 7,900 cords of wood, 349,000 lineal feet poles, 14,467 fence posts.

A telephone line has been completed by the District from Winnipeg to Indian Bay. Residences have been erected for the engineers. Offtake drainage ditches have been dug. Roads have been built and other small works have been carried forward to prepare for the aqueduct construction.

Falcon River Diversion Dyke and Canal.—The water of the Falcon River, which drains about fifty square miles of muskeg area into Indian Bay, is dark-colored and requires some time to clear itself, through the natural agencies, wind and waves. To give the elements time to act on this water before it could possibly reach the intake, a dyke and canal are being provided to divert the Falcon River into Snowshoe Bay. Tomlinson and Fleming, who have the contract for this work, have nearly completed the dyke, which is some 7,500 feet long and contains some 250,000 yards. They have also finished the work on a temporary canal. The method of depositing the material in the dyke by use of dinky engines, four-yard Western side dump cars and scow, proved rapid and economical.

Concrete Aqueduct.—The aqueduct, 85.04 miles in length, has been designed for a minimum rated capacity of 85,000,000 Imperial gallons per day. It will be built of concrete and will be reinforced where under pressure or at other required points. The standard sections are arch or horseshoe-shaped for the gravity flow portions and circular for the parts of the line under pressure. There will be five depressed sections at river crossings, eight blow-offs and weirs, and two venturi meters. The average gradient is 0.62 per 1,000 feet, the lightest 0.11 feet per 1,000 feet, and the heavi-


Circular pressure section.

Arch section.

Test aqueduct sections.

Test aqueduct sections.

est 1.54 feet per 1,000 feet. The table at the bottom of the page gives the various gradients together with sizes of the aqueduct section.

Contracts for the construction of this aqueduct have been let to the following concerns:—

	Contract No.	Contract Section.	Station to Station.	Miles.	Amount.
J. H. Tremblay Company, Limited	30	Prairie	656 + 50 to 1718 + 00	20.15	$ 945,945
Thomas Kelly & Sons	31	Brokenhead	1718 + 00 to 2655 + 98	17.75	1,301,485
Northern Construction Company	32	Whitemouth	2655 + 98 to 3617 + 00	18.20	$1,268,680
and	33	Birch	3617 + 00 to 4466 + 50	16.10	1,137,010
Carter-Halls-Aldinger Company	34	Summit	4466 + 50 to 5148 + 60	13.00	1,489,520
		Total			$6,142,640

This work will include the following quantities of material:—

		Yards	
Top soil excavation		171,000	
Earth		1,988,000	
Rock		20,300	
			2,179,300
Foundation, embankment and refill			284,000
Concrete:			
Aqueduct		349,000	
Culverts, etc.		5,085	
			354,085
Lumber	M.F.B.M.		12,475
Reinforcing steel	lbs.		5,344,000
Cast iron and steel	lbs.		71,000
Cast iron pipes	lbs.		29,500
Cast iron gates			185,200
Cement (not included in the above contracts)	bbls.		500,000

The cement, sand and gravel will be furnished by the District. At present tests are being made relative to the best aggregate available from the various gravel pits owned and leased by the District, to be used for the concrete. This sand and gravel will be excavated from the District's gravel pits by means of a steam shovel and will be put through a screening and crushing plant, screened to several sizes and remixed, after which it will be hauled to the work by daily supply trains operated by the District or under contract.

Four seasons will be required to complete the work on the aqueduct contracts.

Prospective Contracts.—While the largest con-

Aqueduct Sections—Deacon to Indian Bay

From Sta.	To Sta.	Length in Feet	Length in Miles	Aqueduct Section	Slope in Feet per 1000 Feet	Remarks
656 + 50	900 + 00	24,110	4.572	8'-0" Diam.	[illegible]	Contains Venturi Meter.
[illegible]	1234 + 00	33,100	6.326	[illegible]	.30	
[illegible] + 00	[illegible] + 00	18,100	[illegible]	[illegible]	1.537	
[illegible] + 00	2000 + 00	[illegible]	6.856	[illegible]	[illegible]	
2000 + 00	[illegible] + 00	[illegible]	[illegible]	7'-6" Diam.	Depressed Section	Brokenhead River Crossing
[illegible] + 00	[illegible] + 98	[illegible]	8.257	7'-4" x 6'-2¼"	[illegible]	
[illegible] + 98	[illegible] + 98	30,000	5.682	[illegible]	.60	
[illegible] + 98	[illegible]	[illegible]	11.400	7'-5½" x 6'-3½"	[illegible]	Contains Depressed Section at Whitemouth River Crossing.
[illegible] + 30	3816 + 30	[illegible]	[illegible]	[illegible]	1.29	
[illegible] + 30	[illegible]	[illegible]	[illegible]	7'-11½" x 6'-8½"	[illegible]	[illegible] Birch River Crossing.
[illegible]	4592 + 60	[illegible]	[illegible]	[illegible]	.30	[illegible]
[illegible] + 60	[illegible]	[illegible]	2.061	8'-10¼" x 7'-5⅝"	[illegible]	
[illegible]	[illegible]	11,100	2.102	10'-9" x 9'-0"	[illegible]	
[illegible]	[illegible]	[illegible]	6.392	10'-9" x 9'-0"	[illegible]	[illegible] Falcon River Crossing.
	Total Length	[illegible]	85.066			

tracts have been let on this work there still remains the following work for which tenders will be called at this time:—

Work	Estimated Cost in Consulting Engineer's Report.
Intake at Indian Bay	$ 50,000.00
[illegible] steel pipe line from Transcona to Red River	896,400.00
Tunnel under Red River	129,900.00
48-in. cast iron pipe line from Red River to McPhillip's reservoir	278,200.00
	$1,354,500.00

In addition there will be equipment for the railway, gravel plant and other small items.

Financial arrangements have been made through the Bank of Montreal fiscal agents for the District by a Committee of the Water Board headed by Mayor Deacon. These will provide some $4,000,000 in all, the funds necessary for the work completed, the work in hand and that to be carried out next year. Arrangements have also been made with a view to the requirements of the succeeding years.

The first year closes on the Greater Winnipeg Water Supply with the work well up to schedule. During the period much has been accomplished. Permission to divert water from the Lake of the Woods, which ensures a plentiful supply, has been obtained from the International Joint Commission. A broad enumeration of the efforts put forth this year towards carrying this enterprise to a successful completion may be stated as follows: surveys; title to land for right-of-way, gravel pits, etc.; design of aqueduct structures; construction of railway; construction of dyke and canal; and last, but not least, the financing of the scheme.

Cost of Collecting, Hauling, Transferring and Transporting Refuse Materials[*]

By Samuel A. Greeley

ONE of the most important elements in the collection, haul, transfer and transportation of refuse materials is the cost. Many local factors enter into the cost element, and unless these are considered and understood, the cost data are misleading. Standard forms for recording cost data of refuse collection are not used extensively, so that the data presented should not be taken without qualification. In all cases, reference should be made—if possible—to the original source of the information. Methods of analyzing the cost of various parts of the service are given, followed by the actual cost data.

ELEMENTS OF COST

The elements of the cost of each part of the collection service can be studied advantageously by the following method. The unit quantities used in the computations were assumed for certain local conditions and will not necessarily apply everywhere. They are presented here to illustrate the method of analysis.

Loading.—The cost of loading will vary with the character of the material, the district served, the season of the year, the unit cost for labor in each locality and other local conditions. The method for loading garbage follows:—

(a) Number of people per house or per collection unit 10
(b) Number of minutes required to make one collection or to give service to ten people 1
(c) Interval of days between collections 2
(d) Capacity of garbage wagons in tons 2
(e) Quantity of garbage produced in tons per 1,000 population per day 0.273
(f) Quantity of garbage after two days' interval between collections, tons per 1,000 population per day 0.546
(g) To make collections from 1,000 people requires 100 collections, taking 100 minutes' time ... ...
(h) Time in minutes required to load a wagon with two tons of garbage in accordance with the data above equals $\frac{2}{0.546}$ x 100 ... ... 367.
(i) The time required for loading is thus 6.1 hours.

If the cost of the team, wagon collector be taken at 75c per hour, the cost for loading one two-ton wagon will be $4.57 and the cost per ton for loading garbage ($2.28) 2.28

The analysis can be applied to the loading of ashes, rubbish, mixed refuse or any refuse material, if the proper unit quantities and basic data be first determined. The cost per ton for loading other refuse materials in accordance with assumed data will be as follows:—

Materials	Cost of Loading Per Ton
Ashes	$0.415
Rubbish	2.62
Mixed refuse	0.56

Motor Trucks.—The cost of loading a motor truck can be studied in a similar way. The cost of operation will be greater per hour and the rate of loading will have to be increased proportionately to make the cost compare with loading a team wagon. The cost of haul by motor truck will be less.

The use of motor trucks in refuse collection service will increase. A relatively high loading cost can be reduced by limiting the motor truck to transportation after the loading of the wagons by the so-called traction and trailer system now being tried on a large scale in New York City and used in quite a number of European cities.

Hauling.—The refuse material loaded in the collection wagon must be hauled to the transfer station or place for final disposal. This will be done by horse-drawn vehicle or by motor. The length of haul will be from the point of last collection to the place of final delivery. This distance or haul must be covered twice for each complete load.

The cost of haul will depend on the rate of travel, the weight of the load and the cost of the team and the driver, or motor and mechanic. The cost of team haul may be analyzed as follows:—

ASSUMED:

	Miles an Hour
Rate of travel	3.0
Cost of outfit	0.75
Cost per mile travel	0.25
Cost per mile haul	0.50
Cost per ton mile haul with a two-ton load..	0.25

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[*] Paper read before the American Society of Municipal Improvements.

The cost of haul by gasoline or motor truck may be analyzed as follows:—

ASSUMED

	Miles an Hour
Rate of travel	6.0
Cost of outfit	$2.40
Cost per mile travel	0.40
Cost per mile haul	0.80
Cost per ton-mile haul with a five-ton load	0.16

The rate of travel will vary considerably from different sections of a large city, being slower through streets congested with a large volume of traffic. In such districts collection work should be done at night or during the early morning hours.

Transfer Stations.—The operation of transfer stations should also be considered as a part of the cost of transportation. A transfer station to handle 600 cubic yards a day or 375 tons may cost, depending upon type of building and local conditions, about $50,000, including land in a fairly well-built-up section.

The annual cost of operation may be estimated as follows:—

Interest at 5 per cent.	$2500.00
Depreciation of plant	1250.00
Labor:—	
1 Foreman	1200.00
4 Laborers	3600.00
Repairs and supplies	2500.00
Total	$10800.00

This is equivalent to a cost of 9.4c per ton.

The cost of transportation of refuse from the transfer station to the place of final disposal depends upon the method used. The cost for several methods is discussed below.

Trolley Transportation.—Assume a typical transfer station receiving 600 yards of refuse material a day. Assume trains to be made up of one motor car which carries no load and two trailers. Assume each trailer to have a capacity of 25 cu. yds. To move 600 cubic yards, 24 trailer loads are required. If the place of disposal be so located that each train can make two trips a day, six trains will be required. Assume that three motors can handle the six trains. The daily cost of operation will then be:

Motor cost, three at	$25.00 to $75.00 a day
Trailers, twelve at	6.00 to 72.00 a day
Total	147.00

If the 600 cu. yds. of refuse weighs 375 tons, the cost of trolley transportation will be 40c per ton.

Barge Transportation.—A good serviceable tug will cost about $30,000 and deck scows about $7,000 each. The annual cost of operating a fleet may be as follows:—

Annual Cost of Tug:		
Interest at 5 per cent.		$1500.00
Depreciation on 15-year life		1389.00
Labor:—		
Captain	$2100.00	
Engineer	1800.00	
Fireman	1000.00	
Deck hands	1800.00	
		$6700.00
Repairs		2500.00
Fuel		3500.00
Supplies		1000.00
Insurance		200.00
Total		$16789.00
Annual cost of Barge:		
Interest	$350.00	
Depreciation	324.00	
Deck-hands	1800.00	
	$2,474.00	
Assume that 1 tug serves 4 barges		$9896.00
Total annual cost of fleet		$26,685.00

If each barge makes one trip a day, carrying 100 tons of refuse, the cost per ton amounts to 22c. In like manner the elements of cost can be determined for other methods of transportation.

Steam Railroad Transportation.—The cost of transportation by steam railroads depends principally upon the switching charge. These will range from $5 to $15 a car. A car will hold about 40 tons of gar-

Cost of Collection (Loading and Team Haul)

For Refuse Materials—1914

City	Year	Population Served	Total Annual Cost	S. A. G. Total Anl. Tonnage	Total Anl. Yardage	Unit Cost Per Ton	Unit Cost Per Yard	Cost Per Capita	Reference
Garbage									
Boston	[illegible]	[illegible]	[illegible]	[illegible]		$2.43		[illegible]	Annual Report.
Chicago	[illegible]	[illegible]	381,171.00	119,159		3.20		[illegible]	Civil Service Commission
Cleveland	[illegible]	[illegible]	[illegible]	13,555		2.93		[illegible]	Annual Report.
Columbus	[illegible]	[illegible]	34,779.23	18,789		1.85		0.18	Annual Report.
Dayton	[illegible]	[illegible]	21,000.00	9,911	[illegible]	[illegible]	1.56	[illegible]	
Detroit	[illegible]	[illegible]	[illegible]	[illegible]		1.96		[illegible]	Annual Report.
Evanston	[illegible]	[illegible]	3,186.00	[illegible]	[illegible]	[illegible]	0.68	[illegible]	Annual Report.
New York	[illegible]	[illegible]	[illegible]	336,981		0.82		[illegible]	
Winnipeg	[illegible]	[illegible]	19,371.90	[illegible]		[illegible]		[illegible]	Annual Report.
Ashes									
Boston	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	Annual Report.
Evanston	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	Annual Report.
Winnipeg	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	Annual Report.
Rubbish									
Columbus	[illegible]	[illegible]	[illegible]		75,096		[illegible]	[illegible]	Annual Report.
Evanston	[illegible]	[illegible]	[illegible]		29,479		[illegible]	[illegible]	Annual Report.
Ashes and Rubbish									
Cleveland	[illegible]	[illegible]	[illegible]	[illegible]	202,752	1.42	[illegible]	[illegible]	Annual Report.
Cincinnati	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.33	[illegible]	[illegible]	Annual Report.

lage, so that the switching charge will average about 20c per ton.

Available Collection Costs.—Actual cost data should be studied to check the costs estimated above, but these are not available for a large number of cities. The costs for collection service are generally recorded to include both loading and hauling in one figure, while costs of transportation are frequently given separately. The cost data for some cities in which the itemized cost of collection is available have been summarized in the following tables:

Chicago Data.—Jacobs & Senfield have made a careful analysis of the cost of collecting garbage and ashes, the rubbish in Chicago. This data is compiled in excellent detail and accuracy. The average costs for the five years—1908 to 1912—are given in table.

Average Cost of Refuse Collection

(Loading and Hauling)
Chicago, Ill.

Year	Cost Per Ton of Garbage	Cost Per Cu. Yd. Ashes and Rubbish
1908	$3.78	$0.56
1909	3.76	0.57
1910	3.43	0.59
1911	3.19	0.62
1912	3.20	0.60

If ashes and rubbish together weigh 1,000 lbs. per cu. yd. the cost of collection per ton amounts to $1.20.

IMPROVED METHODS FOR RECORDING COST DATA

The value of unit cost data for loading, hauling, transferring and transporting refuse materials should be realized by city officials. Accurate records should be kept and published in similar forms in different cities, so that comparisons can be made and a check secured on the efficiency of the local work. The total costs should be decided and recorded in accordance with the details discussed to show the cost of each element of the work.

Drainage Structures

By W. E. Atkinson[†]

DRAINAGE structures, like many other features of highway construction, require the consideration of many factors in determining the type and character of construction adaptable to any particular location, or in determining a uniform standard or design to be used throughout any particular proposed highway project. Inasmuch as road construction together with drainage structures are more or less problems to be solved by every State or highway commission to meet local conditions, I shall not attempt to set forth any rules or plans governing the type or construction of all drainage structures, but merely present to you some of the general methods, factors and policies governing the construction of such drainage structures in Louisiana, under the supervision of its highway department.

In determining the length of bridges and spans between bents and piers and the size of culverts, consideration is given to the maximum rainfall, amount of run off, average slope of ground of drainage area, seepage, etc., as included in the same factors governing similar structures under railroad construction. After determining the required opening for waterway, the factor governing the required strength or carrying power of the structure is determined, so far as it is possible, upon the maximum load the structure is likely to be submitted during its bonded life. As to the bonded life of structures of this character, it is figured that they should last until bonds or taxes voted for the construction of same are retired, all structures being computed, however, to safely carry a minimum live load of not less than ten tons, plus 50 per cent. impact and a factor of safety of four.

It has been the policy of the highway commission of Louisiana to construct, wherever funds and conditions will permit, permanent structures and adopt uniform and standard plans for bridges and culverts for any particular highway project, however, oftentimes different designs are necessary to meet existing conditions, the type and design of bridges, whether they be of wood, concrete, or masonry, etc., are determined largely by the amount of funds available, and the character and nature of soil for foundation.

Due to the alluvial character of the soil, with the exception of some sections in the northern part of the State, there are instances where it is not safe nor economical to construct the arch type of concrete bridges; even with some of our girder and slab bridges, it oftentimes becomes necessary to provide pile foundations for the piers, abutments and wing walls. In some places it is necessary that these piles be of concrete instead of wood on account of many reclamation projects, now under way, lowering the ground water which would become detrimental to the latter type of construction.

We have found it advantageous and economical to provide, where conditions will permit, a uniform design for all drainage structures, especially for those of concrete construction, that the contractor may use the same drainage forms over and over, permitting thereby much lower bids per cubic yard on such work than otherwise under a system of non-uniform standard designs for such structures, and in addition, many times permitting without greater cost, greater waterway opening than theoretically computed, resulting in a larger factor of safety, and often providing for some unprecedented rainfall or cloudburst not anticipated. In addition to concrete bridges, the department is building many wooden bridges, both of creosoted and uncreosoted materials, this character of construction predominating in some parishes due to lack of funds for more permanent construction.

The department has installed several types of culverts, that of vitrified clay, cement, concrete, cast iron, wood, corrugated galvanized iron, etc., the type of construction being governed by the available funds and topographical features together with character of soil encountered in foundation, however, where practicable, concrete has always been recommended.

At many places, however, we have found it impracticable and not economical to use concrete culverts and others of a monolithic character, especially in some of the bayous and coulees. In one place in particular, it is recalled, where the foundation in one bayou was so poor that a strip 2 inches by 2 inches by 16 feet was pushed down its full length in the bottom of the bayou, and could have been pushed farther if the strip had been longer. This bayou was 250 feet wide across the top and 25 feet deep, and the only opening necessary was that of an equalizer with an area of some 28 square feet to be filled over with earth, thereby making a bridge of earth and of an equalizer. The equalizer installed at this particular location, was a ten gauge 6 feet diameter corrugated galvanized iron pipe culvert. The entire cost of this combination bridge, if it may be so termed, amounted

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[*] Paper read at Fourth American Road Congress.

[†] State Highway Engineer of Louisiana.

to $2,059.27, including an item of $215.73 for riprap, whereas to have bridged the bayou with concrete, or to have attempted to build a concrete culvert, would have made the cost very much in excess of this amount. The only weak point I see, relative to this construction, is the more or less uncertainty as to the lasting qualities of the culvert from corrosion. This is stated merely to show some of the conditions that have to be met in Louisiana.

Due to debris, drift wood, and other extraneous matter, our highway department has adopted a policy not to install any culverts of less than 18 inches in diameter where possible, it preferring that they should be not less than 24 inches in diameter.

No doubt many of you will take issue with me on this point, but my experience has been that culverts of these sizes have proven more satisfactory and given better service, requiring less maintenance both for road and culvert at such places than when culverts are ample to carry the water, due to the ineffectiveness of the latter from drift choking and filling them up.

I have yet to find my first culvert that is too large for the amount of water and rainfall to be drained, but many have I found that were too small.

The Maintenance of Earth Roads

By George W. Cooley†

WE all know, either through our own experience or from the experience of other investigators, that the economic value of a highway depends to a great extent on its surfacing, and the care with which that surfacing is kept up. The nature of the material used for surfacing, its value as to hardness, toughness and its recementing quality is generally determined from the conditions of each individual case, but one factor remains forever the same, one rule must be continually in force, and that is a continuous and thorough system of repairs and maintenance. Without the careful carrying out of such a rule, the best of roads will deteriorate, the cost of transportation will become greater with each day's neglect, and our road will become a liability instead of an asset. By far the greater proportion of our roads, especially those in States having a large mileage and a moderate road fund, are the common ordinary earth roads either built entirely from the material at hand or covered when permissible, with a surfacing of gravel, sand, stone or clay, as necessities warrant, or conditions permit.

In the consideration of this subject, it is presumed that the fundamental principles of road construction have been followed, i.e., that an ample drainage system has been provided, and that the subgrade or foundation has been built up without the use of perishable material. Unless our road has been so primarily constructed, weak spots will develop when the drainage is imperfect or where sods or vegetable matter have been used in its construction, and the cost of proper maintenance will become excessive.

In the construction of a new earth road made in an open level or rolling country, the use of an elevating grader is quite common and under suitable conditions its use is justified by economy in construction work, but its value as a road builder is lessened if the too frequent result is obtained of casting the sods into the road bed, and depending on the regular traffic to thoroughly consolidate the mass so built up. This can be avoided by the use of a tractor in hauling the grader, which thoroughly pulverizes and packs the material cast in by the grader.

We may safely take it for granted then that in any road bed carelessly constructed with a large percentage of vegetable matter, the future bills for repairs and maintenance will be governed largely by the quality of unsuitable construction material used and in case of a lax system of construction, a more elaborate system of maintenance must be adopted.

I quote the following from Mr. L. W. Page, director of the office of public roads:

> Overtopping all other road problems in its importance is that of maintenance. The destructive agencies of traffic and the elements are unceasing in their activities, and it is idle to talk of permanent roads any more than to speak of a house, a fence or railroad ties as permanent. The public roads today, by reason of the exceptionally obstructive traffic conditions, are more costly in construction and this cost is continually increasing with the advance in the prices of labor and material. It is criminally wasteful, therefore, to invest large sums of public money in building the highways demanded by traffic, unless the investment is conserved by adequate maintenance.

We conclude, therefore, that continuous maintenance being such an important factor in the general scheme, especial effort must be made to install a satisfactory and economical system as soon as a road is opened to travel. In some of our western States, the plan has been suggested of requiring contractors on surfaced roads to provide for maintenance as soon as any section is completed, and continue the same for at least thirty days after the work is accepted, thus giving time for the engineering department to provide for the organization of a maintenance crew without overlapping or interfering with the work of construction; and in Minnesota the plan has been adopted in the construction of earth roads to require the continual use of a drag or planer on grade building. This latter plan has been found very efficient and renders future work on the surface less expensive, besides tending to produce a more compact road bed. The tool found most satisfactory in this work is that known as the "Minnesota Road Planer" which consists of the two blades of an ordinary road drag, fixed between a pair of runners about 14 feet long, the blades set at an angle of about sixty degrees to the runner and made rigid or adjustable as may be deemed best. The planer is hauled on a line parallel with the axis of the road and its operation is simtlar to that of the ordinary drag, with the additional advantage of making a smoother surface. The old style drag without runners has a tendency, especially on new work, to increase the "waves" or undulations frequently occurring on road construction, while the planer eliminates these faults, and as a general maintenance tool has proven the most satisfactory.

An important feature of maintenance is prevention of the growth of sod and weeds along the travelled track. When sod is allowed to form along the highway, it has a tendency to catch the dust and wash from the road surface, and soon becomes a high, rough shoulder, preventing drainage. The use of a spring tooth harrow along the roadside two or three times a year will prevent this growth.

The State of Minnesota has given special atten

Paper read at Fourth American Congress.

†State Highway Engineer of Minnesota.

tion to the matter of maintenance and in the present road laws have made adequate provision for the care of all roads. Township and county roads constitute approximately 90 per cent. of the road mileage of the State, and of these roads, about 90 per cent. are earth roads. To care for the town and county roads, a one mill tax is levied on all property in the town and proceeds of which constitutes the town dragging fund. This fund is expended under the direction of an overseer, appointed by the town board, for the purchase of drags, and in dragging all roads of the town, excepting State roads. This appears to be the most satisfactory method of caring for the earth roads under control of the local authorities, but there should be a provision in such cases, for general supervision of the work by the county highway engineer.

For the care of State roads in Minnesota, 20 per cent. of the State road funds, with a due proportion of county funds, is set aside and may not be used for any other purpose than maintenance of State roads. As the State roads include all types of construction, different systems of maintenance have been required in the different localities. In general, three systems have been established: The patrol system on macadam and well built gravel roads, and the maintenance section system, and road drag system on other roads, all being under the direct supervision of the district highway engineer.

Under the patrol system, one man is assigned a section of from 5 to 7 miles of road and works with hand tools. It has been found necessary to supplement this work with the occasional use of a team and in that manner it has proven satisfactory on macadam and gravel roads.

Under the maintenance section system, one man is given charge of a section of from 20 to 30 miles of road and is employed continuously with his team on the care of his section. He is given authority to employ additional help, both teams and men, and usually has two teams and four or five men at work. Contracts are also entered into by the section foreman with residents along the road, for the dragging of same after each rain, or when ordered to do so by him. The section crew takes care of all minor items of construction, such as placing culverts, etc., and we have found that the work when properly done, is really of a constructive nature. This system is without doubt the most effective, and is being adopted generally throughout the State.

The dragging system requires the employment of a superintendent of maintenance, who for convenience should be one of the engineer's assistants, whose duty is to contract or make arrangements for the dragging of all roads under his charge, and to see that the work is done at proper times. This system is suitable for slightly undulating prairie country, where most of the roads are of earth, and to get best results, the superintendent should have at his disposal light graders to reshape the road bed at least at the beginning of each season.

On earth or gravel roads, no maintenance system is complete which does not contemplate the use of planers or similar devices, and a combination of work as outlined under the section system is recommended.

The Australian importations of black and galvanized wrought iron—or mild steel—butt welded tube constitute large figures. While Canadian tube is becoming favorably known throughout the Commonwealth, it is an anomaly that few malleable iron pipe fittings—black and galvanized—of Canadian make are imported into Australia. Illustrations of and quotations for large quantities of elbows (known here as bends) might lead to immediate business. All malleable iron pipe fiittings used in Australia are of the standard English Pipe Committee (Whitworth) thread no others are saleable.

The Antiquity of Cement

EXAMINATION of Roman buildings constructed from 750 B.C. to about 300 A.D. appears to show that until the second century B.C., concrete was not employed by the ancient Romans. Before 100 B.C., some monumental structures containing concrete were erected, and from that time onward the material was increasingly used with considerable variation of composition and in exterior facing. On this point, Mr. E. B. Van Deman, in the American Journal of Archaeology, says: "In no period was concrete used to any extent without facing except in foundations and other invisible parts of buildings. Roughly at the beginning of the Christian era it reached the position of dominant material (or mode) of construction."

During the reign of Julius Caesar, concrete became quite common for foundation and the massive parts of masonry buildings, and some structures of this period are to be found consisting entirely of concrete faced with stone. In the time of Augustus, concrete construction became practically universal for foundation work, the massive parts of buildings and the core of walls. Besides using concrete in buildings, the Romans employed it for the construction of sewers, water mains, aqueducts and highways.

The dome of the Pantheon, erected 123 A.D., is the finest example of ancient concrete work extant. The dome is 142 ft. in diameter with an opening of 30 ft. diameter at the top, and has withstood the destructive influences of the weather for nearly 2,000 years without showing appreciable injury.

From the downfall of the Roman Empire to the latter part of the eighteenth century the manufacture of cement appears to have been discontinued. Modern Portland cement is undoubtedly far superior to the crude product of the ancient Romans, and it is consequently obvious that modern concrete should prove even more lasting than its prototype.

Tar-Macadam Work on Roads

DISTILLED tar should be used in order to procure a first-class material, especially where it is necessary to lay the tar-macadam a few days after the mixing, says a writer in the London "Surveyor." In cases where the material can be allowed to mature for a period of about eight or nine weeks, gasworks tar will give excellent results. Exposure to the air causes the light oils, etc., to evaporate; consequently, the setting properties of the macadam are vastly improved.

If it should be necessary to lay the material a few days after the mixing, a small proportion of lime added to the tar and stone during mixing will improve its setting properties. The lime generates heat, and therefore tends to drive off light oils, etc.

Roads in country districts are generally some considerable distance from railway stations, and it frequently happens that the material cannot be carted at a rate sufficient to enable the rollers to work full time. In these cases it is necessary to clump the tar-macadam on the road side so that it can be barrowed and spread when sufficient material has been accumulated to keep the rollers and gangs working at a reasonable pressure. Large clumps should be made, and the material in them kept as high as possible. Before commencing to remove the material, it is advisable to spray a small quantity of hot tar over the side of the clump next to the passing traffic.

The objection to small clumps is mainly due to dust raised by motor traffic adhering to the tar, and the amount of earthy material which would be shovelled up with the lower layers of the heaps.

Should it be necessary to scarify a surface prior to treating it with tar-macadam, the disturbed crust should be tightly steam-rolled before the new material is applied.

It has been found an advantage to water the old surface during hot weather before spreading the tar-macadam. Paradoxically, it is not advisable to sprinkle water on the roller wheels; a better job can be made by keeping them clear of tarry material by constant brushing with hard brooms.

The finished coating should be tar-painted and dusted with slag dust as soon as the material has worked to a smooth surface under the action of traffic. Under ordinary heavy traffic the tar should be lightly applied fourteen days after the completion of the rolling work.

It has been the practice to tar-paint tarred macadam every other year. The life of the material can be much prolonged by lightly painting soon after rolling, and every subsequent year.

Trade Enquiries

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of the "Contract Record" may obtain the names of enquirers by writing to the Department of Trade and Commerce and stating the number of the enquiry.

1097. **Wire Nails.**—A Manchester firm of nail manufacturers and importers wishes to get in touch with Canadian exporters of wire nails.

1098. **Screws.**—A Manchester firm of nail manufacturers and importers wishes to get in touch with Canadian exporters of screws.

1099. **Bolts and Nuts.**—A Manchester firm of nail manufacturers and importers wishes to get in touch with Canadian exporters of bolts and nuts.

1100. **Cold Rolled Hoop Iron.**—A Manchester firm of nail manufacturers and importers wishes to get in touch with Canadian exporters of cold rolled hoop iron.

1122. **Barbed Wire.**—A South African manufacturing firm is prepared to take up agency or purchase direct, barbed wire from Canada if quotations are satisfactory. Immediate correspondence requested.

1136. **Engineering Specialties.**—A London firm of engineers, claiming a good connection among contractors, builders and merchant houses, would be glad to hear from Canadian manufacturers of engineering specialties, tools, and articles associated with the building trades, who seek an export connection.

[illegible] **Boiler Tubes, Plates, Shafting, etc.**—A North Country firm would be glad to hear from Canadian manufacturers of boiler tubes for marine boilers, mild steel shell plates and furnace plates for marine boilers, and mild steel propeller shafts, tunnel shafting, and thrust shafts for marine engines, of which they seek supplies.

It is gratifying to learn from reliable sources that the arrival of cold weather has given an appreciable stimulus to business in the West. The general trend of reports received at the office of the Contract Record is that the farmers having finished fall operations money is being circulated more freely, individual debts are being reduced and mortgage payments are showing improvements. Collections continue to improve and the indications are that the next monthly returns will show an improvement over those of the corresponding month of last year. Conditions generally are encouraging, evidence of which is found in the fact that farmers in most districts are putting their crop money into circulation.

The Ontario Street High Level Bridge St. Catharines, Ont.

Contributed by Herbert L. Clark

The Ontario Street High Level Bridge at St. Catharines, Ont., when completed, will connect the business district of the city with Glen Ridge, a new suburban development on the east bank of the Old Welland Canal. The Ontario Street Bridge, in design, was an approximate copy of a light (narrow gauge) railway in the south of England.

The bridge was to be of solid concrete masonry construction, twelve piers, 56 feet centre to centre, and thirteen arches of 50 feet clear span, with a rise of 20 feet, and roadway width of 20 feet on the arch and a 5-ft. cantilevered sidewalk on the north side.

Ontario Street Bridge, St. Catharines, under construction

The city undertook to build the bridge by day labor and the work was started in the early part of 1913. By October all of the piers and four arch rings had been practically completed. At this time it was decided to increase the capacity of the bridge and to complete the work by contract. Accordingly Mr. N. S. Sprague, consulting engineer, of Pittsburgh, Pa., prepared plans, calling for a reinforced concrete bridge with a 26-foot roadway and a 6-foot sidewalk. Part of the roadway and the sidewalk was to be carried by cantilever brackets. Provision was made for interurban trolleys by a single track, close to the sidewalk.

The accompanying illustration, which is from a photo taken from the top of the west tower of the cantilever, looking toward Glen Ridge, illustrates the cantilever brackets.

It is expected to have the bridge opened to traffic about this time. Frank L. Cohen, of Buffalo, N.Y., is the contractor and is represented on the work by Wright & Haswell, consulting engineers, of Buffalo. Mr. George Watson and the writer are acting for the city.

Uses of the Hydraulic Mining Cartridge*

Possibilities Which Have Received Inadequate Consideration—Methods Employed in Reservoir, Harbor and Foundation Work

By James Tonge

THE difficulty of removing rock and other material in places where the shock attendant upon blasting operations would be damaging and dangerous to surrounding strata or foundations is one which has not hitherto been thoroughly overcome.

The enormous initial power generated by the sudden decomposition of exposive substance has enabled great quantities of natural or artificial beds to be displaced, and a great portion of the work of the civil and mechanical engineer is involved either directly or indirectly in operations of this kind. The objection to the use of explosives, however, in many circumstances is that the effect of blasting can seldom be harnessed or controlled so as to prevent the disintegration of the material beyond the area which it is desired to dislodge. . . . . Pulverisation by explosives involves enormous waste of power, as it usually represents great excess of explosive charge; in other words, the use of explosives must involve either the risk of accident through an insufficient charge or the production of misapplied energy.

The hydraulic mining cartridge differs from all other mechanical substitutes for blasting. It is not worked on the principle of the wedge, and consequently the power expended in forcing a wedge into the hole is saved. Instead of employing a wedge, the disrupting effect is obtained by means of a number of small rams or presses working at right angles from a strong cylinder of steel. In order to make these rams more effective in their operation, by obtaining a greater travel from their original position, they are made of a duplex or telescopic form, one part sliding and fitting upon the other. In some cartridges these pistons operate from each side of the cylinder alternately, thus greatly increasing the travel. To retain the rams in position a sliding plate is used fitting in grooves in the barrel. This is so formed and secured that it is perfectly rigid and firm when the machine is in operation, but is readily removable if it is desired to detach or replace any of the rams. By a suitable arrangement of passages a communication is made between each of the rams, whereby simultaneous action is obtained. Machines are made of various diameters—viz., 2½ in., 3¼ in., and 4 in.—and of various lengths, say with 8, 6, or 5 rams, the smaller diameters having the larger number of rams. Pressures of 3, 4, or 5 tons per square inch are usual, so that machines are made to withstand great stresses.

The Pump.—The cartridge is operated by means of a pump, to which it is directly connected by a pipe. The pump is of special design. At the commencement of the supply of water it is desirable that the latter should be supplied in such quantities as to fill up quickly all the spaces within the rams and passages, while at the same time allowing the operator, when the rams begin to move and the pressure to increase, to supply a less quantity of water, but at a greater pressure, to complete the final operations of the rams.

In practice it is found possible so to arrange the hydraulic cartridge holes as to enable much greater areas of material to be moved than could be done with a safe quantity of explosive, while in some cases the displacement has been greatly extended by the use of small-sized boreholes towards which the slowly developing line of least resistance can assert itself. In other words, the power exerted by the rams can be controlled, after a little experience, so that the full pressure can be usefully applied.

Use in Reservoirs, Docks, Harbours, and Canals

The operations in these places have all certain features in common which allow of their being classed together, and they may be divided into three classes.

(a) **In Open Trenches.**—The difficulty of removing rock from confined spaces where it is necessary that no shock or vibration should be transmitted to surrounding strata is a very vital one. The introduction of the hydraulic cartridge into this class of work will, it is hoped, help to solve this question. During the past few years it has been thoroughly tested under most varied conditions and in all classes of deposits.

The work in trenches usually proceeds as follows: A number of holes are drilled, say, 2 ft. 3 in. back from the edge of the rock, about 5 ft. apart, and 3 ft. to 5 ft. deep, according to circumstances. The holes are, when possible, bored by a power drill operating from a tripod. By these means suitable holes, of diameters up to about 5 in., can be quickly drilled. The centre hole is pumped first and provides a loose end for those on each side. These are pumped in turn until the fast side is reached, where it may be found advisable to drill a small 1 in. diameter hole, say 9 in. from the fast side, to enable the cartridge to break the rock as close to the fast side as possible. Sometimes this method is varied by pumping off two centre holes simultaneously and placing the last holes 2 ft. from the fast side, leaving out the small diameter holes. In this case the holes could be 2 ft. 6 in. from the front edge, and two machines would be required.

Taking a trench 15 ft. in width and holes 3 ft. in depth, the first method would necessitate three cartridges and two 1-in. holes to get 100 cu. ft. of rock; while the second method would require only four cartridge holes to remove 112 cu. ft. During the operation of the machine it is possible to see the rock slowly fracturing at each turn of the handle. Work of this character has been done by the cartridge in connection with the Derwent Valley waterworks, and the Cwm Taff reservoir, Liverpool Corporation, and tests are now being made for the Abertillery water scheme.

(b) **Under Water.**—The appliance has been used in many cases under water, chiefly to remove rock, either from the sides of canals or from the sides of harbors and docks, where it was obviously impossible to use explosives, the machines being operated from the bank or from pontoons.

In the Alexandra Docks at Newport, and in the new dock at Swansea, the appliance has been used to break up ledges of rock occurring in the vicinity of walls which would have been damaged by the use of explosives. The holes were put in and the cartridges inserted under water by divers, and pressure was applied from the pump placed on a raft on the water.

(c) **Dock or Harbour Walls.**—Hydraulic machines have been used for some years at the Dover Harbour works for the purpose of detaching the large concrete blocks used in the harbour walls. These blocks are of great size and weight. By inserting the drill hole along the bottom of the block and placing the cartridge about half-way under it, the whole mass is slightly lifted and tilted without breaking, and being thus released from its bed is easily lifted on to a wagon by a crane. Machines are being used for a similar purpose in other docks.

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* From a paper read at a recent meeting of the Society of Engineers (Great Britain).

Excavation of Foundations

The question of the removal of concrete foundation beds by a method which would not involve explosive blasts and would avoid the slightest damage to machinery or buildings has been carefully studied recently by the writer, and had never been thoroughly solved until extended trials in all parts of the British Isles had been made.

The effect of powerful hydraulic pressure upon concrete is interesting. In the case of sandstone and shales there is comparatively slight crushing of the rock before the full pressure of the rams has the effect of causing the mass to bend; considerable pumping and consequent travel of the rams is then necessary before the rock finally begins to crack and break away. With concrete, however, there is usually a perceptible interval during which the rams are crushing or compressing the material, and no movement is noticeable; after this is accomplished a few more thrusts of the rams cause the whole mass to break up without any indications of bending. It may still be necessary to continue to apply pressure and to increase the size of the breaks in the mass, but the greatest shattering effect will have been accomplished at the first disclosure of the cracks, the pressure required to break the mass afterwards gradually diminishing.

In such material explosives invariably have the effect of "hacking a way through" by the shortest direction to the unsupported edge, pulverising the mass, but failing to take advantage of pressure gently applied, by means of breaks, which spread and widen, and to utilize the weight of the concrete itself to increase the scope of the operation. Numerous experiments in this class of work show that 60 to 70 cu. ft. of concrete can be easily removed per thrust.

The general procedure in attacking beds of concrete may be divided thus: (1) By vertical cartridge holes; (2) by horizontal cartridge holes.

(1) **By Vertical Cartridge Holes.**—This method is most applicable to places where power can be easily obtained to bore the holes by tripod and power drills. The cartridge holes are drilled about 3 ft. deep and 2 ft. 9 in. back from the front edge of the bed. It has been found of great advantage to drill small diameter holes 3 ft. away and in line, to which the fracture will break. In this way a bed 15 ft. wide could be broken all across by two cartridges and two small diameter holes, amounting to 124 cu. ft. of material.

(2) **By Horizontal Cartridge Holes.**—In this case the holes would be 3 ft. deep, and made to lift 3 ft. of material per thrust, the vertical small diameter holes being put in as before. The amount of material moved per thrust is 67 cu. ft. The effect of lifting up is to break a larger quantity of material and in much larger pieces than is the case with vertical holes. With the latter the concrete is found to be very well broken up and ready for handling without the further use of tools. Horizontal holes, on the other hand, are more suitable for beds where foundation bolts are embedded in the concrete.

There appears to be no class of work so suitable for this machine as the removal of concrete beds. The following recent case is a typical example. At a municipal electricity works the cartridge was used to remove the main engine-room foundation bed. Within a radius of 40 yards from the scene of operations, many of them within the same building, were very valuable Lancashire and water tube boilers, electrical and steam engines, and the main switchboard and cables. Needless to say, the work had to be carried out with as little vibration or shock as possible. Explosives were out of the question, and the ordinary method of hammer and wedge would have proved an extremely long, tedious, and expensive process. The bed consisted of a solid mass 14 ft. 6 in. wide, 26 ft. long, and 10 ft. deep, composed of hard cement concrete for the most part, and reinforced with numerous foundation bolts.

It was considered unnecessary to instal power drills on the work, and the holes in consequence were drilled by hand. The majority of these were horizontal, and were put in by means of an ordinary twist drill and ratchet machine by two men. These men could drill fairly easily 3 ft. per hour. One hydraulic cartridge only was employed. The general procedure was to keep the drillers at work putting in holes all round the side of the concrete, the machine following when two or more holes were ready. The holes were on an average 6 ft. 6 in. apart, and from 2 ft. 6 in. to 3 ft. below the surface in the case of horizontal holes. The vertical holes were drilled only in special places to trim down the vertical edge, and in these cases the measurements were about the same. The employment of shot holes to form a breaking point was considered unnecessary.

The debris thus broken was removed by a gang of six men, who were kept busily employed with pick and shovel, and wedges were necessary only to break up the larger pieces to a suitable size for handling. It was found that the amount of material broken up in the course of three or four shots was quite sufficient, in consequence of the limited and cramped working area, to keep the men busily employed for the rest of the day. Had it been possible to place more men on the bed there is no reason why a much better output should not have been attained, but in this case it would have been necessary to break open the wall in several places, which was not considered advisable. The whole bed, weighing approximately 200 tons of concrete, was removed in twenty working days. About sixty shots were necessary to complete the work, making an average of nearly 3½ tons per thrust.

The above cases will be sufficient to show that with a mechanical substitute for blasting capable of exerting a total pressure of 150 or 200 tons upon rock, coal, concrete, masonry, etc., and in such manner as to cause no shock to the material in which it is operated, there should be possibilities of usefulness to engineers not previously contemplated.

At Edmonton, exterior work is progressing favorably on the new armory which is being erected on the Hudson Bay Reserve at a cost of $286,000. The general contractors are Messrs. P. Lyall & Sons.

In Montreal, the value of the building permits issued from January 1 to October 31 this year totalled, roughly, $17,000,000, as compared with rather more than $21,000,000 for the corresponding period of last year.

The New Sewage Disposal Plant at Aberdeen, S.D.

Details of Design, Construction, Operation and Cost, with Points of Practical Interest brought out in a Discussion of the System

PART I.

By W. G. Potter

ABERDEEN, South Dakota, is a town of about 12,000 population, and is located on flat prairie land, having very little fall in any direction. The city boundaries include about four square miles; the extreme variation in elevation does not exceed 15 ft. and that only in a very small portion of the city. No large streams flow within reach of the town for sewage outfall. The only stream at all available is a small, sluggish creek called Moccasin Creek, which flows through the eastern part of the city. Into this both the storm sewage and the sanitary sewage empty, and for the larger part of the year the only current in the stream is from this flow of sewage, increased by the waste and overflow from the artesian wells.

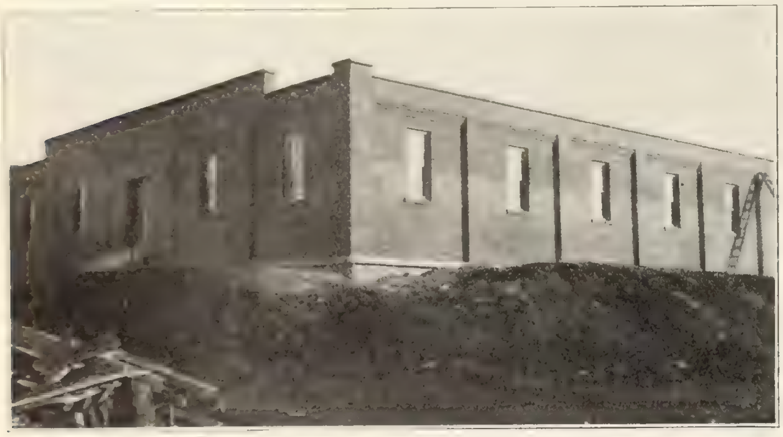
Fig. 1.—View of exterior of sedimentation tank.

Aberdeen, being in the artesian belt of South Dakota, derives all of its water, both for the municipal supply and for a large number of private supplies, from artesian wells. The pressure from these wells is very high, the static pressure amounting in some instances to as much as 240 lbs., while the hydrant pressure around town usually runs about 60 lbs., with a night pressure sometimes up to or over 100 lbs. One city well of 8 ins. diameter gave at first about 2,300 gallons per minute discharge from a depth of 1,270 ft. Many of these wells of smaller size are left flowing all the time, and because the storm sewer system is as yet very limited, this overflow goes into the sanitary sewers, thus greatly increasing the volume to be pumped and purified. Aside from this, the sanitary sewers contain very little except domestic sewage and the wastes from several laundries.

Old Disposal System.—The system in use heretofore has been as follows. All sewage has to be pumped. The pump station was located within a mile from the business district, and the sewage of the city is collected at this place in a 36-in. concrete sewer about 25 ft. deep. From this main the sewage entered three concrete wells inside the pump house, each 8 ft. in diameter, and each extending about 5 ft. below the 36-in. inlet pipe. In these wells were three centrifugal pumps, operated not continuously but with periods of rest lasting not over three hours, during which the sewage rose some 10 ft. or more in the wells and backed up in the main sewer correspondingly. The pumps were all submerged and hard to get at for repairs. They were operated by a vertical shaft and belted to a countershaft under the floor. The engine was a 55 h.p. Muenzel gas engine, deriving its power from one 60 h.p. and one 100 h.p. gas producers. With this engine, the sewage was lifted about 19 ft., run through a 16-in. force main about 1,000 ft., and then again lifted about 10 ft. into the septic tank. This tank was of concrete, partly with flat concrete roof and partly covered with a concrete block building. The windows and doors were all boarded up, and there was absolutely no ventilation, with the result that in places the concrete was entirely disintegrated by the sewage gases, leaving holes through the roof. There was no further purification, and the sewage entered the stream almost as foul as it entered the tank, this pollution continuing for a mile below the outlet of the stream, and emitting an odor that often reaches the residence district. Both the pump station and the septic tank were of poor concrete or concrete blocks, and as the former was in a dangerous condition, it was considered advisable to build an entirely new plant.

The new disposal system was planned to consist of a new pump house with larger pumping capacity, a force main to the new plant, a sedimentation tank, a sprinkling filter, sludge filter, and final settling tank.

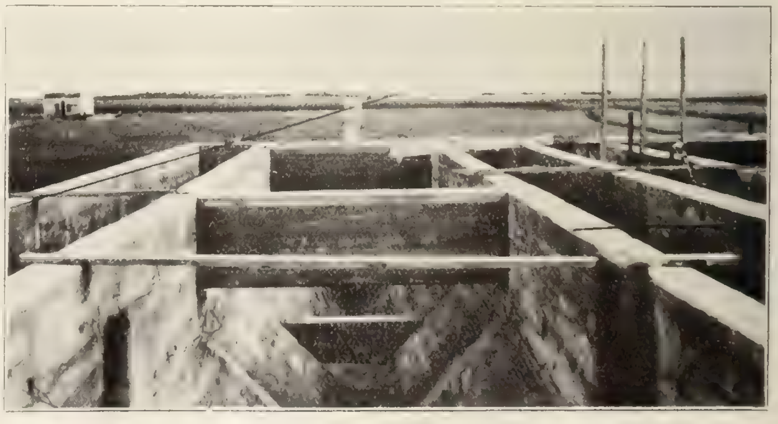
Fig. 2.—View of interior of sedimentation tank showing inclined sedimentation floors.

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[*] Paper presented before the Hydraulic, Sanitary and Municipal Section of the Western Society of Engineers.

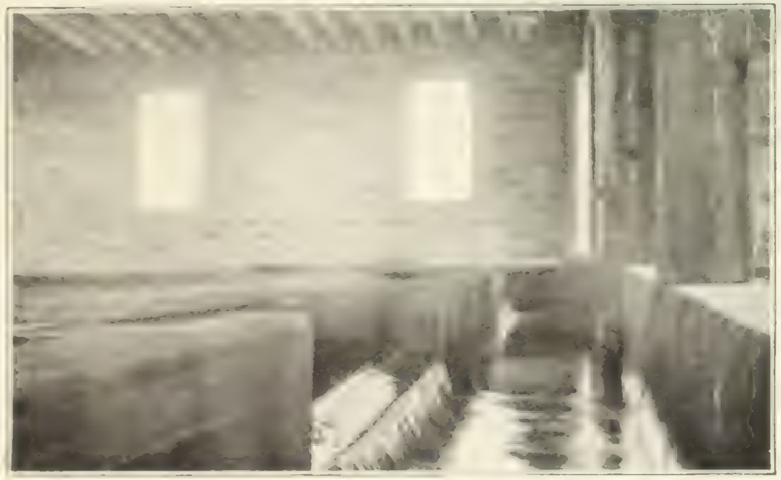


Fig. 5.—Interior of sedimentation tank in operation

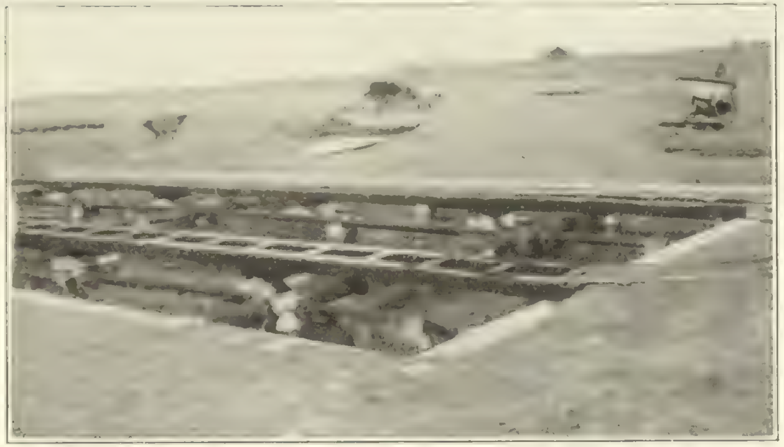


Fig. 4.—Sludge filter in operation

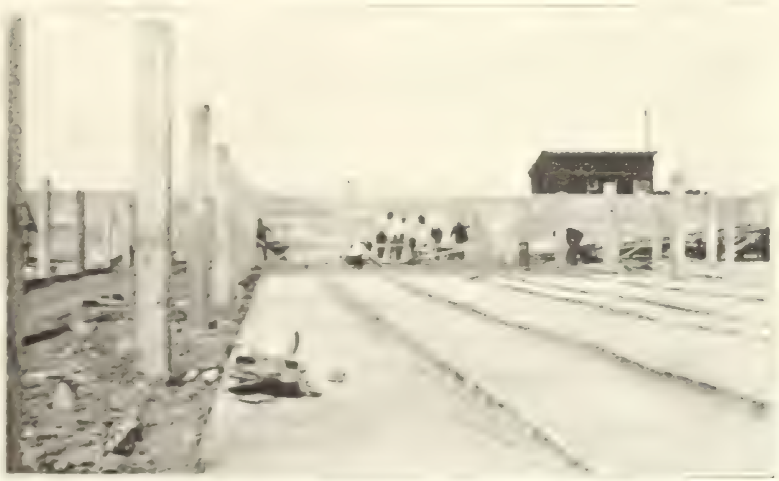


Fig. 7.—View of sprinkling filter showing drainage channels and roof supports

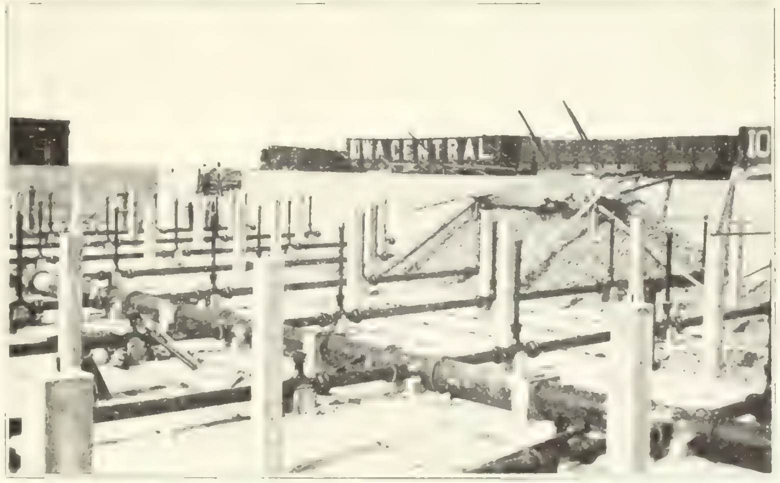
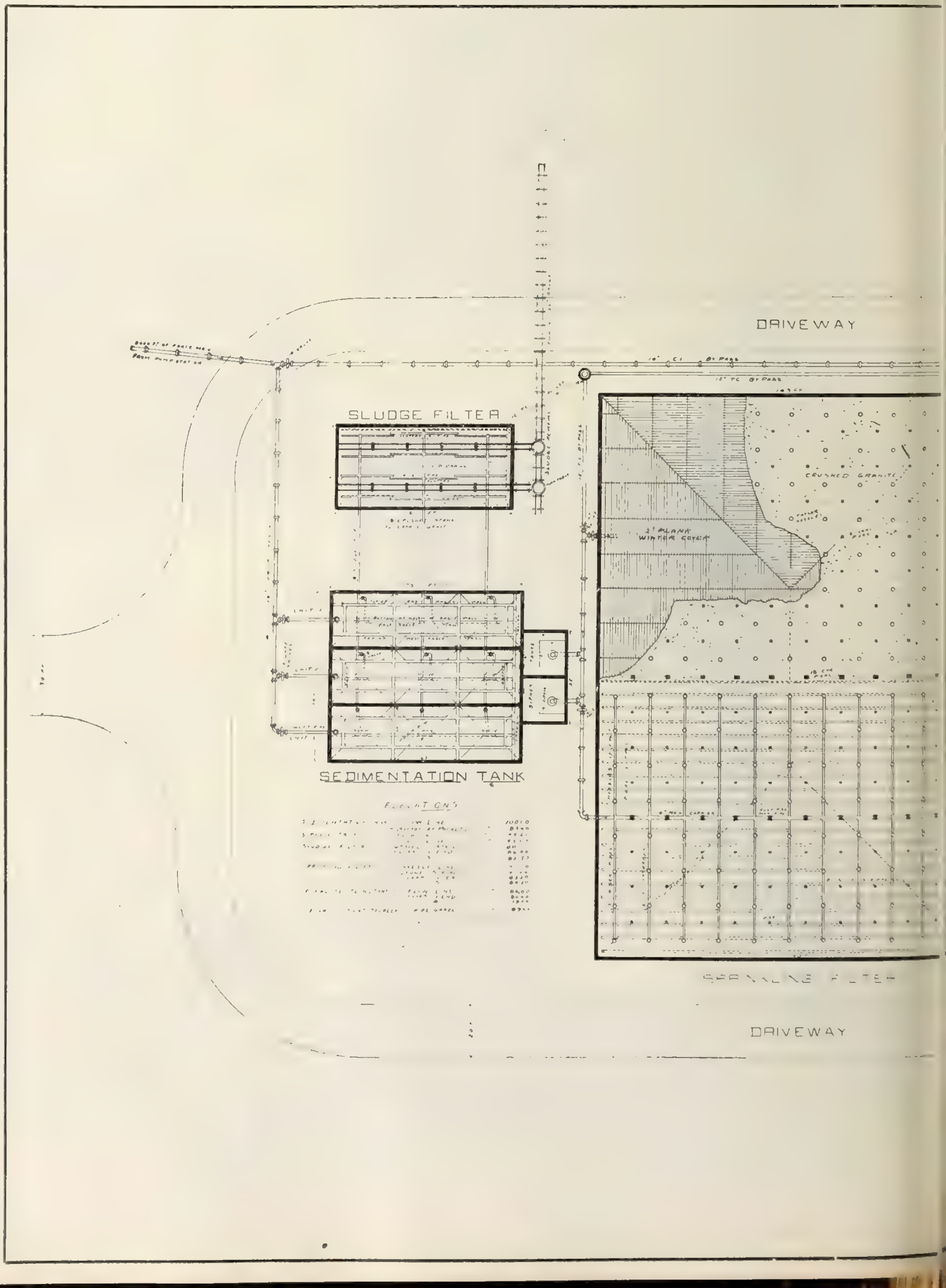


Fig. 6.—Sprinkling filter showing piping arrangement for sprinkler head

The location decided upon was about two miles south of the town at the junction of Moccasin Creek with another small stream, Foote Creek, where some little additional flow would be obtained, at least in the spring and in wet seasons.

New Pump House.—Because of the concrete pump wells and the main sewer being in good condition, it was decided to locate the new pump house upon the site of the old one. The problem became to remove the old building, erect the new one, put in an additional engine and producer, put in three new pumps, and change the position of the old engine and producers, and still keep the pumps going with no shutdown of over the three-hour period. The first thing done was to remove the old building and erect the new one with the walls on new foundations just outside the old ones, thus making the new building slightly larger than the old one. This new building was made of brick with concrete roof on steel girders. Then the old pumps were removed one at a time, the wells were filled with concrete to the grade of the incoming sewer, and cast-iron inlet pipes and gates were concreted into the old terra cotta inlets. Connected with these inlet pipes are the three pumps—one 8-in. and two 10-in. Lawrence centrifugal pumps—so that all will be operated in the dry, and easily accessible for repair. Each pump has a vertical shaft running to a bevelled gear connection with a horizontal shaft above the floor. This horizontal shaft is built in three sections so that either pump may be operated independent of the other. By direct belts this horizontal shaft is connected to the old 55 h.p. and the new 100 h.p. engine. Both are of the Muenzel type of gas engine built by the Minneapolis Steel and Machinery Company. The horizontal shaft is also connected to a 30 h.p. motor for emergency, and this receives its power by wire from the Aberdeen Light & Power Company. In the producer room of the pump house the old producers have been changed in position and a new producer and wet scrubber added. Adjoining the producer room is a hopper-bottomed coal room, from which the coal is elevated to a point above the producers and distributed to each. Another room is equipped with a forge and small tools for repairing, cutting pipe, etc., for the city forces. A soft water well of 2-in. size, about 1,000 ft. deep, is now being bored to furnish water to the producers, as it is found that the hard water from the deeper wells has a corrosive effect on the steel pans. The reason for continuing the use of the producer gas engines was that this method has been very successful and very cheap for the old plant, and we did not wish to discard the old machinery. While I can give no accurate cost figures for the operation of the pumps, the cost has been within 1½c. per kw. hour against a 6c. rate from the light and power company for electricity. The pumpage for the new station will be continuous instead of periodical.

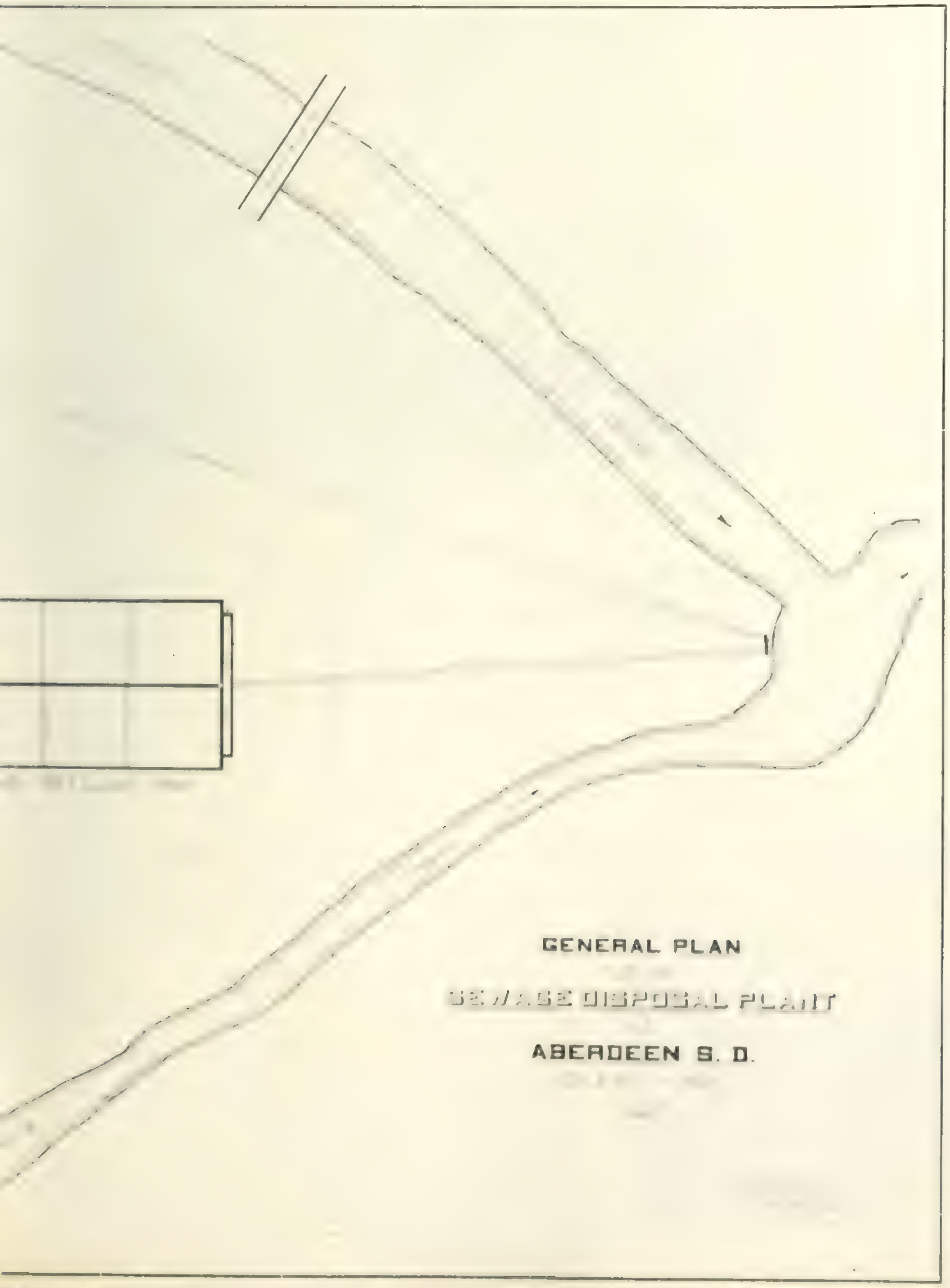
Force Main.—From the pump station the new system will utilize about 300 ft. of the old 16-in. force main, and will then connect to the plant with a new 14-in. main about 9,400 ft. long. The pumpage through this main will be normally about 1,500,000 gallons per day, which will give a barely self-cleansing velocity. It is considered that this pipe will carry the sewage without excessive friction until the discharge is about doubled, when another parallel pipe will be necessary. The force main is laid on a gravity grade from the pump station to the plant, with a by-pass at the plant,



so that in case of not being able to pump into the plant at any time they could either pump through the main to the stream or they could empty the main entirely by force of gravity.

Sedimentation Tank.—The sedimentation tank is rectangular in shape, 64 ft. by 73 ft. outside, and consists of three units, any one or all of which may be used at one time. Each unit has three pockets, 20 ft. by 23 ft. at the top and 2 ft. by 5 ft. at the bottom, in the shape of an inverted square pyramid. Suspended angle walls form the upper storey from which the sludge falls into the pockets. As the sewage is almost altogether domestic in quality, no grit chambers are used and the entrance of the sewage will be at one end of the tank only, through a 14-in. pipe in each unit from the force main, this pipe turning up inside the tank to a point about 6 ins. below the flow line. The depth of pockets and of sewage will be 17 ft. The flow line of the tank is about 10 ft. above the natural ground line. The outside walls of the tank are 15 ins. thick at the coping near the top and 24 ins. at the bottom, with piers extending well below the frost line at the corners and at the intersection of the unit walls with the pocket cross walls and outside walls. All are heavily reinforced. Above the coping of the outside walls the concrete is 3 ft. high and about 8 ins. thick, with a facing of brick outside. Above the concrete is a building of brick and hard-burned tile, for the purpose of keeping the sewage warm and accessible during the winter. This building covers both the sedimentation tank and siphon tanks, and has a roof of wood construction supported by posts on the unit walls and covered with Carey roofing. Ventilation is secured by means of doors, windows, and three ventilators in the roof. No waterproofing was necessary, except painting the inside surfaces with asphalt paint. Very few seeps were found on filling the sedimentation tank, and those were caused by water following the wires used in holding the forms together. All seeps were easily stopped by using a little pitch on the inside at these places. Each pocket has its sludge pipe and valve, 8 ins. in size, and the pipes from the corresponding pockets in the three units combine, forming three main sludge pipes which extend through the east wall of the sedimentation tank to the sludge filter.

The Sludge Filter.—The sludge filter is located 30 ft. east of and parallel to the sedimentation tank. It is 32 ft. by 67 ft. in size, uncovered, and built of plain concrete with 12-in. walls. It is laid with a 6-in. floor, in which are shaped concrete drains about 5 ft. apart. The walls of the filter come up to about the natural ground line, and the depth is 4½ ft. at the north end and 5 ft. at the south end. The filter material consists of about 18 ins. of crushed stone from 2 to 4 ins. in size, above which is 12 ins. of coarse gravel. The three mains from the sedimentation tank enter the filter just below the top of the wall on the west side, and each divides into a system of 4-in. cast-iron laterals supported on piers just above the surface of the gravel. Each of these laterals is slotted for nearly its full length and open at the end to facilitate cleaning. In operation, after receiving the charge from the sedimentation tank, the sludge is allowed to dry on the filter. The liquid filters down to the sub-drains, and is carried away through a 12-in. main to the filter by-pass, and runs through that around the outside of the sprinkling filter to the filter trough, thus getting the benefit of passing through the final settling tank. To facilitate re-



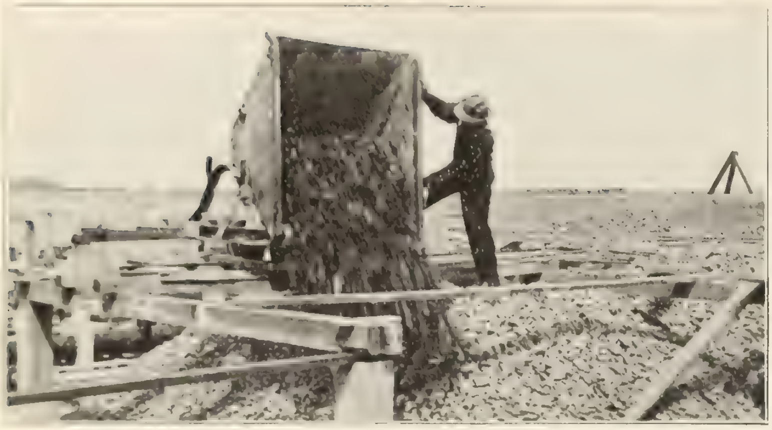


Fig. 7.—Sprinkling filter being filled with broken stone.

moval of the dried sludge, two tracks of 24-in. gauge, for industrial cars, are laid on concrete piers over the surface of the filter. The dried sludge will be spaded by hand into the cars and then removed to low ground and used for a filler.

Siphon Tanks.—The liquid, after passing through the sedimentation tank, passes over an 8 ft. weir in each unit, and into a trough, from which it goes through two 18-in. sluice gates into the two siphon tanks. These are adjoining the sedimentation tank, and are covered by the same building. They are each 16 ft. square at the top with three sides sloping, 10 ft. square at the bottom, and are fitted with a 14-in. Miller siphon of 5 ft. maximum discharge depth. Each one of the siphon tanks contains about 7,000 gallons when at discharge depth, and when running together each will discharge about once in fifteen minutes. Veeder trip counters will be used with float attachments to register the number of discharges of each siphon. The siphons discharge into a 14-in. main between siphon tanks and sprinkling filter, and branch 14-is. mains enter the filter in two places. By control of the gate valves, either siphon may be used for either half of the sprinkling filter, or all of it, and if necessary the discharge of the siphon may by-pass the filter altogether and come into the final settling tank.

Sprinkling Filter.—The sprinkling filter is 143 ft. by 209 ft. inside, with plain concrete walls 8 ins. thick at the top and 16 ins. at the bottom. A 6-in. concrete floor is laid throughout, and in it about 4 ft. apart, are 8-in. terra cotta half tile sub-drains. Each subdrain has a flat concrete cover, 18 ins. long, 10 ins. wide, and 1½ ins. thick, with two ribs which raise it 1½ ins. above the floor to allow the water to enter. These covers were designed and cast in Aberdeen and well seasoned before using. The filter floor has a fall to the south of 1 ft. in the width of 143 ft. On this floor crushed granite of 2-in. to 4-in. size was spread to a depth of 5½ ft. at the north end and 6½ ft. at the south side. One hundred and seventy-two carloads of rock were necessary to fill the filter to the required depth. The 14-in. main distributor enters the filter from the siphon tank in two places, each controlled by its gate valve. These mains run south through the filter on concrete piers about 1 ft. above the floor. Every 13 ft. on each main a 6-in. lateral extends east and west, and at each 13 ft. on each lateral is a 3-in. riser pipe, on which is a Taylor square nozzle. There are 88 of these nozzles on each main, or 176 altogether in the filter. Each lateral is laid on a grade to drain to its main, and each main drains to the south end. There each main has a 2-in. drain running to the filter trough, which may be opened by a stopcock, thus draining the entire distribution system if necessary at any time. On account of the usual extreme cold during the winter season, some precautions were necessary at any time. On account of the nozzles and filter. For this purpose, concrete piers were built midway of the nozzles, and 13 ft. apart in each direction. On these piers, rising above the surface of the stone about 6 ins., 4 by 4 posts were erected with 4 by 6 stringers, and on this framework a temporary winter cover of 2-in. plank is laid. The plank cover only will be removed during the warm season, the framework being left in place, although this framework is so built as to be removable without drawing a nail. This roof is of a flat hip roof construction with 3 ft. rise to the centre. All wood used on this was painted with a wood preservative before using. The sprinkling filter covers 0.68 of an acre, and with the present normal flow of about 1,500,000 gals. per day it will have a loading of about 2,200,000 gals. per day per acre.

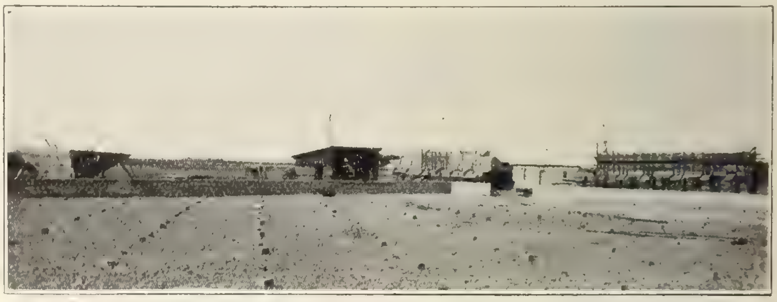


Fig. 8.—Sprinkling filter completely filled with filtering material.

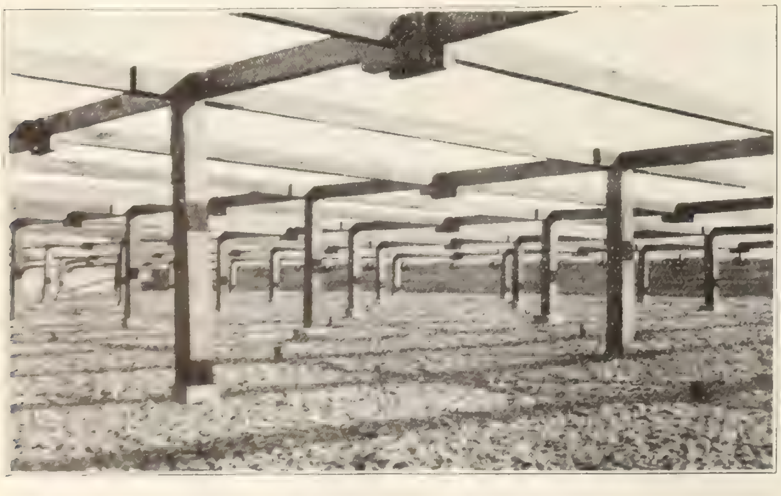
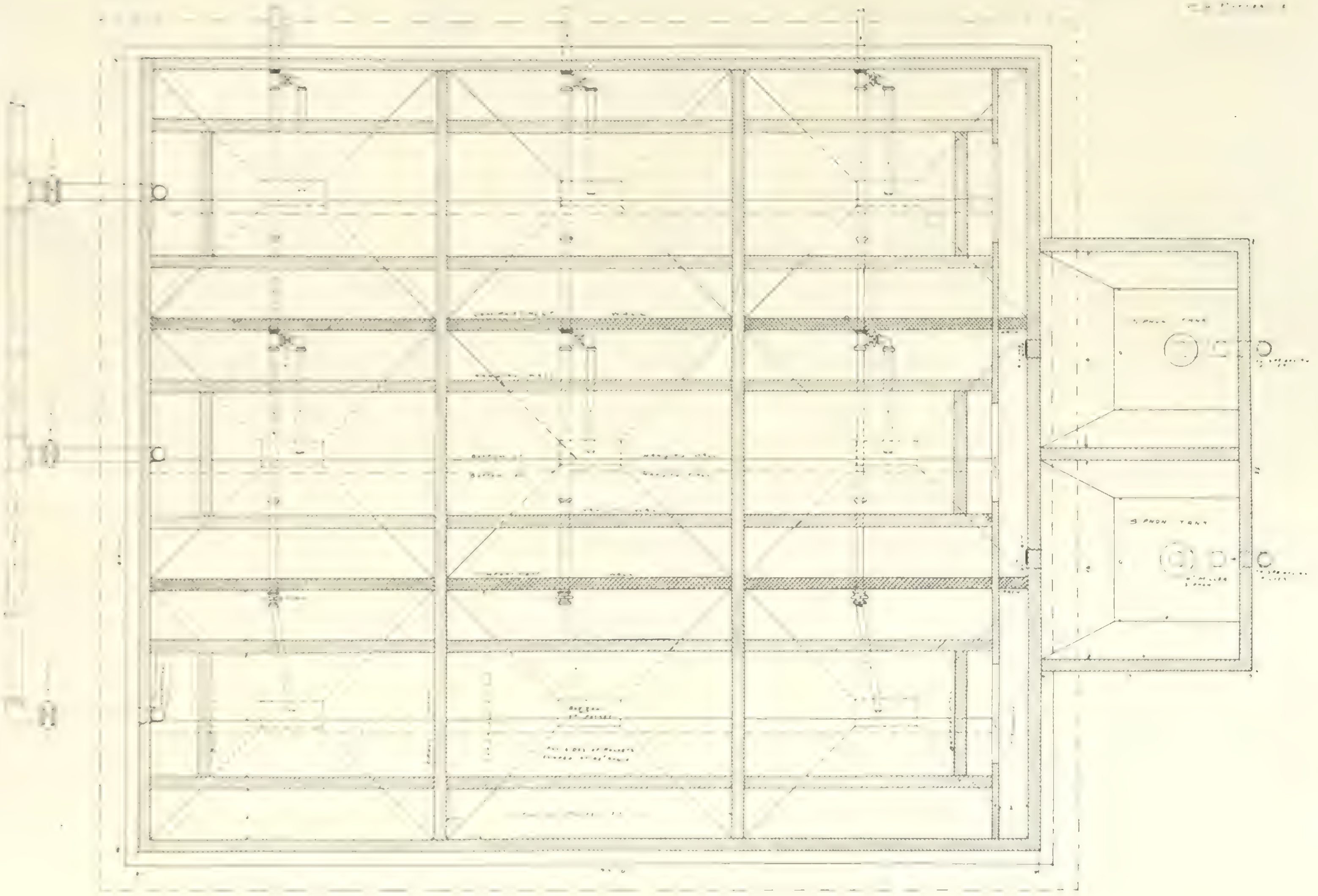


Fig. 9.—Sprinkling filter, showing roof structure.

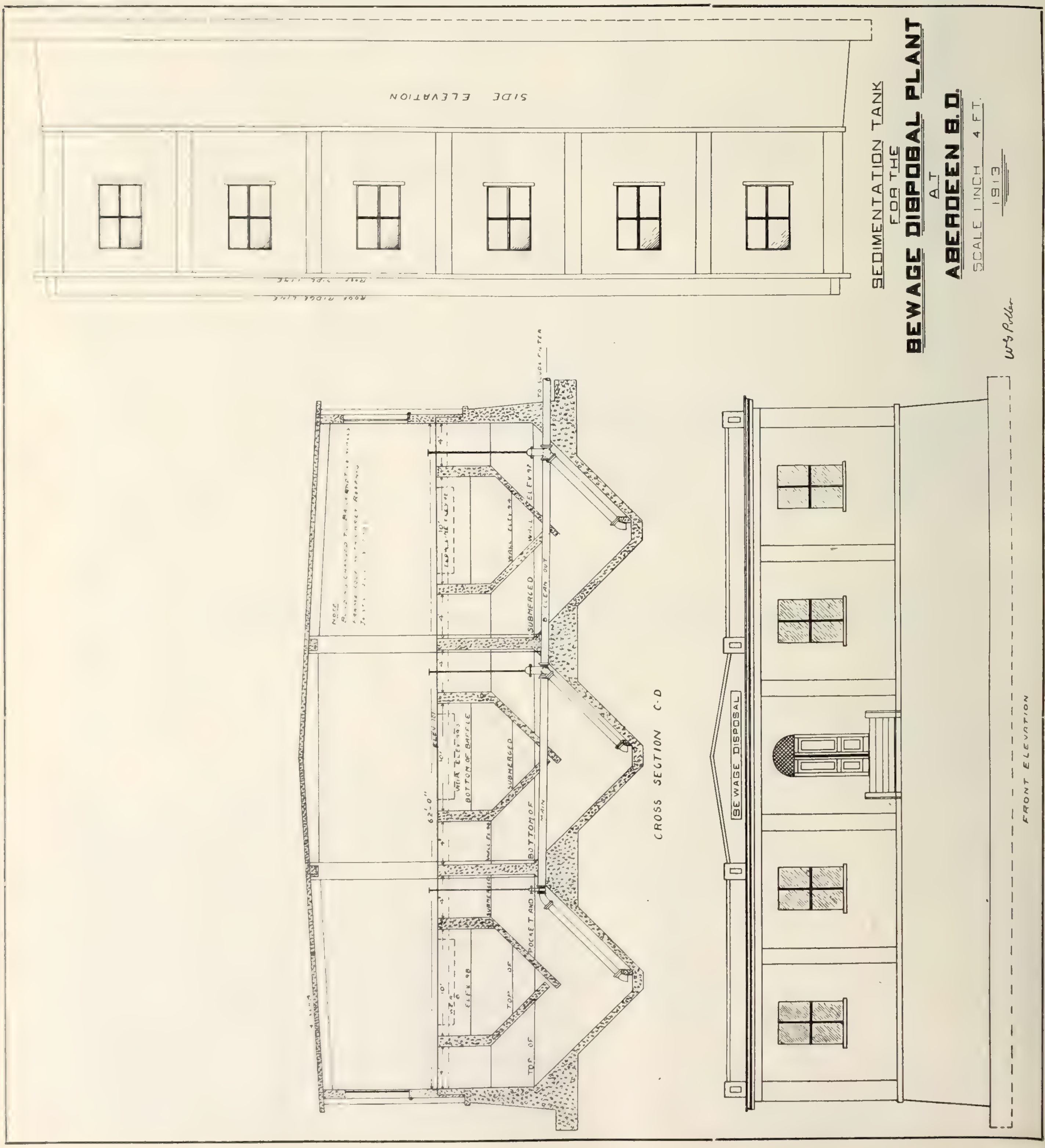
Collecting Trough.—Running along the south side of the sprinkling filter, and separated from it by the filter wall only, is the collecting trough. It is 3 ft. wide, with a floor slightly below the filter floor; the outer wall is about 4 ft. lower than the filter wall and comes up only to the ground line. Arches are built in about 25 ft. apart over the trough to counteract earth pressure from the outside. All of the filter sub-drains pass through the filter wall and empty into this trough. At the east end of this trough also the filter by-pass mentioned above enters, carrying the water

SEDIMENTATION TANK
FOR THE
SEWAGE DISPOSAL PLANT
AT
ABERDEEN S.D.
SCALE 1 INCH = 4 FT
1913



from the sludge filter and from the siphon tanks in case the filter should for any reason be put out of service. Likewise, the force main by-pass has a connection by which the entire plant above this point could be put out of service, if necessary, and still give the sewage the benefit of the final settling tank. This trough could also, in case of a typhoid epidemic or similar trouble, be used for a hypochlorite trough. After the liquid passes into this trough, it flows from either way to the centre and then through a covered trough to the final settling tank.

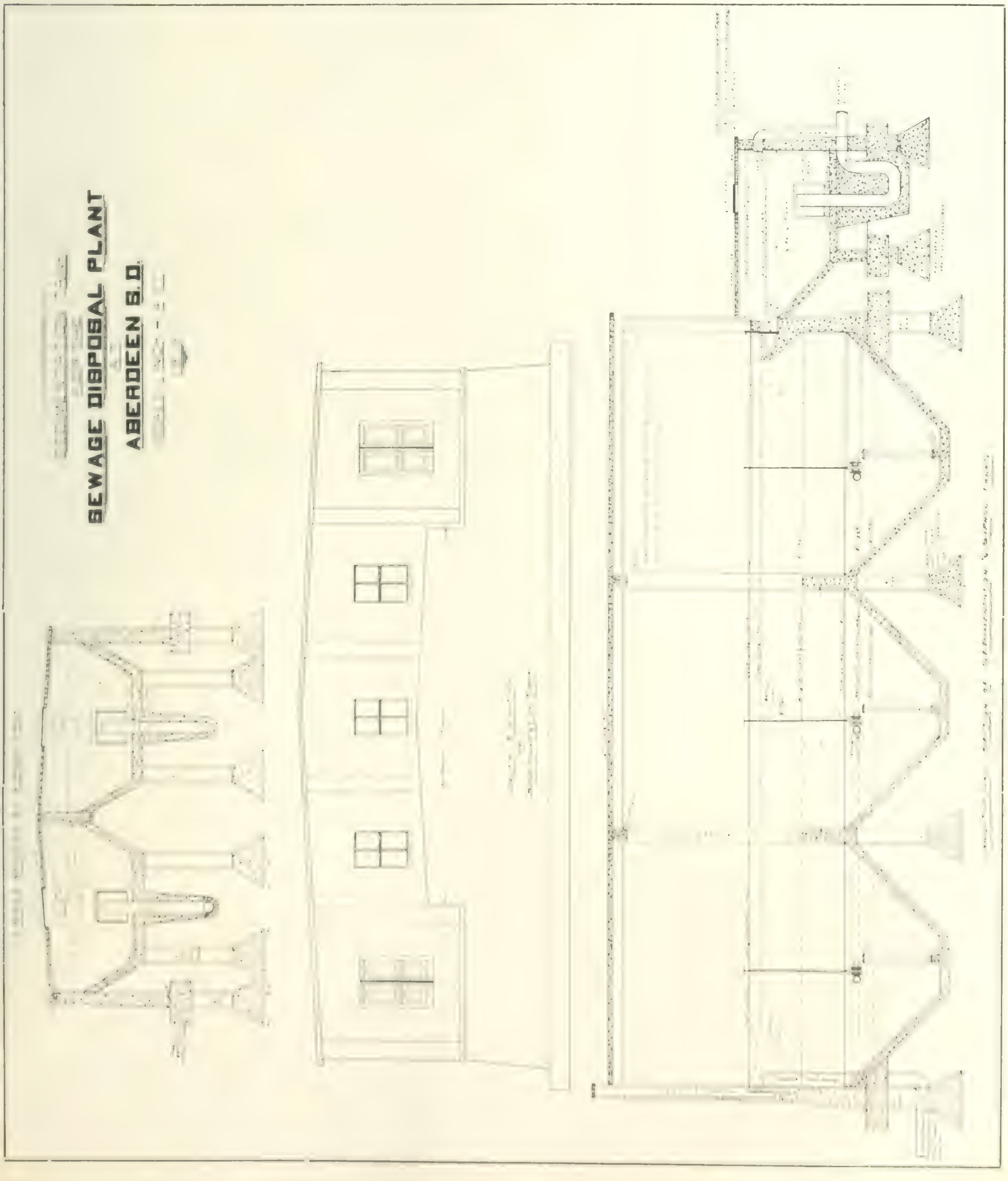
Final Settling Tank.—This is a plain concrete tank 63 by 103 ft. in size, divided into two parts by a middle longitudinal wall. From the collecting trough the flow enters a shallow, reinforced hanging trough, the flow into either half being controlled by a gate. From this trough it passes over a weir the entire width of the tank, to the tank proper. Here it passes slowly through under several reinforced baffle walls to the outlet end. The tank is about 4 ft. deep below the flow line, and it takes the normal flow about two hours to pass through, thus allowing the suspended solids a final chance to settle to the bottom. The floor of the final tank is below the outfall creek, and when either compartment is emptied for cleaning, it will have to be done by gasoline pumps. From the final tank the



effluent passes over two weirs in each half into a final trough, and from there through about 200 ft. of 20-in. terra cotta pipe to the final outfall into the stream.

Head Consumed Through Plant.—The elevation of the main sewer at the pump station is about 74. The sewage is pumped up to elevation 100 at the flow line of the sedimentation tank. The discharge of the siphon tanks is at about 99.5 and the elevation of the sprinkler sprays is 91.5. The floor of the sprinkling filter is 84.5 at the south end, the flow line of the final settling tank is 84.0, and the grade of the pipe at the final outlet is 83.2. This makes a total head consumed in the disposal plant of 16.8 ft.

Auxiliary Work.—Part of the auxiliary work connected with the proposition was the construction of two small reinforced dams across the two streams for the purpose of preventing the backing up of the effluent towards town in case of a south wind and no current. A 2-in. artesian well was also bored about 1,000 ft. deep to furnish water for construction and for other uses. A living house was moved from the site of Aberdeen's new City Hall, about three miles to the



disposal plant, set up on a concrete foundation and remodelled. It was connected with the well and given sewer connection, and is being used by the caretaker as a residence. About 1,800 ft. of railroad track was put in by the M. & St. L. Railroad to facilitate unloading material.

(Concluded in next issue)

Economics of Sewage Filters

Sand, Contact and Sprinkling Filters—Population per Acre of Filter Practicable—Cost per Acre and per Capita—Economical Depth

THE output of a filter of any type depends upon the nature of the sewage, the nature and fineness or coarseness of the filtering material, the method of application of the sewage to the filtering material, temperature, atmospheric conditions and many other factors. The intermittent sand filter is best for obtaining a very high degree of purification; contact filters, sprinkling filters and others are used for a less degree of purification. By using a suitable rate under suitable conditions, however, any type of filter can be made to give any degree of organic purification that may be desired within the limitations of the type in question.

RATE OF FILTERING SETTLED SEWAGE

Sand Filters.—The question of the rate of application of the sewage to a sand filter is largely tied up with that of preliminary treatment by tanks or screens. The following table gives figures for each of several Massachusetts cities, showing the time of detention in sedimentation tanks, storage wells, pump wells or other kinds of storage, and the population whose sewage can be treated per acre of filter. The average of these shows that with 6.7 hours of detention previous to filtering, the sewage from 937 persons can be treated on one acre of filter. The Baltimore sewerage commission in 1906 estimated that sewage which had settled six hours could be treated on a sand filter containing 3 feet of clean sand at the rate of 1,200 people per acre.

	Period of Detention Hours	Population
Andover.	1½–3	950
Brockton	12	1,160
Clinton	12	425
Framingham	12	375
Gardner (Old)	1½	1,310
Gardner (New)	1½	2,000
Pittsfield	12	605
Stockbridge	8	220
Worcester.	1½	1,390
Average of all ...	6.7	937

Contact Filters.—American data for contact filters are relatively few, and the use of English data is rather dangerous owing to the difference in strength of English and American sewage. Experiments at Columbus, Ohio, indicated that contact filters containing 5 feet of stone could be safely operated at an average rate of 600,000 to 700,000 gallons per acre per day; or 500 gallons for a 4-foot depth, equivalent to about 5,000 people per acre. Tests at Lawrence, Mass., on beds of various depth gave an average of about 700,000 gallons per acre for a depth of 5½ feet, equivalent to about 135 gallons per acre of each foot of depth of stone, or again about 5,000 people per acre of 4-foot bed. Contact filters 4½ feet deep covering 3.6 acres at Plainfield, N.J., treated an average of 1.7 million gallons per day in 1910, equivalent to the sewage from 4,200 people per acre of 4-foot bed.

Sprinkling Filters.—For sprinkling filters much more satisfactory data can be had, and their ratings can be fixed with much more dependence. The depth and population per acre of several such filters are as follows: Reading, 5 feet, 18,000; Columbus, 5 feet, 18,000; Atlanta, 6 feet, 20,000; Philadelphia, 6 feet, 20,000; Montclair, 7½ feet, 15,000; Mt. Vernon, 8 feet, 24,000; Baltimore, 9 feet, 20,000; Fitchburg, 10 feet, 50,000. The average of all these is a 7-foot bed with 19,400 population per acre.

For ordinary conditions we may safely assume the following averages: Intermittent sand filters, 3-foot bed of sand, 1,000 per acre. Contact filters, 4-foot depth of stone, 5,000 per acre. Sprinkling filters, 7-foot depth of stone, 19,000 per acre.

COST OF SEWAGE FILTERS

Costs of construction are so much affected by local conditions, such as amount of excavation necessary, cost of materials and distance to be transported, etc., that comparative costs for different localities are to be used only with great discretion, and averages should be used only as a guide to comparative costs in various places. The average cost of the nine Massachusetts intermittent sand filters cited above was $3,260 per acre, or $3.50 per capita using the filters. The Baltimore sewerage commission estimated the cost per acre at $6,350, corresponding to $5.30 per capita.

The cost of contact filters equipped with suitable convenient appurtenances may be taken at about $30,000 per acre for a bed 4 feet deep, or $6 per capita.

For sprinkling filters 7 feet deep the cost will be about $45,000 per acre, or $2.37 per capita.

The relatively low cost of the Massachusetts sand filters, as compared with the Baltimore estimate, is due to the fact that conditions in that section of the country are unusually favorable for such filters. In most cases the costs would more nearly approximate the Baltimore estimate. It appears from this that the cost per capita of intermittent sand filters and contact filters do not differ greatly, and that sprinkling filters are a far more economical installation in the matter of first cost.

Depth of Filters.—The cost of filters will, of course, vary with the depth, but little is known about the relative advantages of shallow or deep filters. Very few tests have been made which give convincing information as to the most economical depth for securing a given degree of purification. In some places filters are made 10 feet, in others 6, and it is certainly worth while to determine which would be the better. In the following comparison it will be assumed that sufficient head is available for any depth adopted without adding to any pumping cost.

This question does not arise for intermittent sand filters, as these are not usually made more than 4 or 5 feet deep, and in general any amount over 3 feet is added merely to increase the number of times that the clogged sand surface can be removed before the entire reconstruction of the bed becomes necessary.

In the case of contact filters, where the amount of air drawn in between fillings is practically equal to the volume of the sewage and where surface clogging cannot be a serious factor, each cubic yard of stone forming the filter will give the same output of purification regardless of the depth of the filter. It would

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[1] Abstract of a paper by George W. Fuller, before the American Society of Municipal Improvements.

therefore appear that it is economical to build a contact filter as deep as local conditions of construction will permit, and the question of economy is therefore one of minimum total cost of constructing a containing basin for a given number of cubic yards of stone.

For sprinkling filters the problem is more complicated. The Royal Commission reported that English practice seems to indicate that the output per unit of volume is the same regardless of the depth; but American experiments do not wholly corroborate this. Our best knowledge seems to indicate that the output per unit of volume is somewhat less for deep than for shallow filters. Therefore, with a relatively decreasing efficiency of the stone as the depth increases, and at the same time a relatively decreasing cost for construction per unit of volume of stone, there must be some point where the greatest output per unit cost of stone will be obtained. Baltimore Sewerage Commission in 1911 estimated, from tests made in Baltimore, that the relation between depth and results would be as follows:

	6 ft.	9 ft.	12 ft.
Relative stability	79	87	89
Per cent. reduction of oxygen consumed	56	70	72

Giving equal weight to the relative stability and per cent. reduction of oxygen consumed, we get the following:

	6 ft.	9 ft.	12 ft.
Relative stability	1	1.2	1.23
Per cent. reduction of oxygen consumed	1	1.25	1.28
Average of the two	1	1.22	1.25
Relative depths	1	1.33	2.00
Relative value of stone per cu. yd. ...	1	.92	.63

Assuming this depth varies at a uniform rate from one end of the curve to the other, we get the following for the relative value of stone per cubic yard:

	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	12 ft.
Relative value of stone per cubic yard	1.0	0.97	0.94	0.92	0.82	0.63

To get comparative figures then between the 6, 8 and 10-foot beds, the cost figures for the 8-foot beds must be divided by 0.94, and the cost for the 10-foot beds by 0.82, putting them all on the basis of the 6-foot bed.

For comparative costs a number of factors such as excavation, etc., are naturally omitted, as they are not affected in all places the same way by the depth of the filter. Comparing, then, only those particular costs which are affected per unit of output by the depth of the filter, we get the following:

	Cost per effective cu. yd. Depth.		
	6 ft.	7 ft.	8 ft.
[illegible]	[illegible]	[illegible]	[illegible]
Fill. [illegible] per square foot for any depth	.49	.44	.40
Walls. Assume cost 0.17 per cubic yard for 6-foot depth	[illegible]	[illegible]	[illegible]
Galleries and Collectors. Assume for 6-foot depth 0.25 per cubic yard	.25	.22	.20
Distribution. Assume 0.50 per cubic yard for 6-foot depth; also, as costs theoretically vary only according to quantity delivered, [illegible]	[illegible]	[illegible]	[illegible]
Stone. Assume $1.50 per cu. yd.	1.50	1.55	1.60
Total	$3.31	$3.23	$3.20

Outside factors will depend on quantity only and not on depth.

It appears then, that there is some slight saving of cost, which, on the figures given in the table, amounts to about 3 per cent. in favor of the 8-foot deep bed as compared with the 6-foot deep bed. On the other hand, it is to be recognized that a deep bed will give a good deal more trouble with pooling and freezing than a shallow bed, and the advantages in favor of a shallow bed due to this lesser amount of pooling will be considerably more than this 3 per cent. difference in cost. Taking everything into account, the writer believes that a sprinkling filter bed of not less than 6 feet and not more than 7 feet will, in the greater number of cases, prove the most economical to use.

The Canada Foundry Company's Toronto works received instructions last week to proceed with the manufacture of shells for the Government. Fourteen of the shells which were recently shipped as a sample to England proved very satisfactory in every way. They were tried in the guns with good results. The staff will work day and night in turning them out. The pump and brass departments have been increased. The other firms making these shells are Chapman Ball Bearing Company, Canadian Fairbanks Company and the John Inglis Company.

The Interior Construction Company, Limited, Winnipeg, state that they use several carloads of calcined magnesite and chloride of magnesia during the year and that from ten to twenty carloads are used in the city of Winnipeg. The company believe that there is a good opportunity for a firm to manufacture this production in Canada, as magnesite is found in its natural form in Quebec. The company state that they have to place an order for a 40,000-lb. car immediately, and up to the present have been unable to secure this material in Canada.

The Cheticamp Gypsum & Plastering Company, Limited, which holds a property three miles long at Cape Breton in Nova Scotia and which was organized about a year ago with a capital of $1,500,000, is putting into practice the theory of conducting business as usual. It has recently completed a new loading trestle over 600 ft. in length and has purchased a second locomotive to handle the output and facilitate shipments of the raw material to the United States. The company has followed up its opportunities so closely that instead of laying off men during the last few months it has increased its staff. To facilitate the building of its business the company has recently removed its headquarters to Montreal.

The Iron Age, commenting on the business situation, says: "The turning point has been rounded, and there is every prospect that the progress will be continued. It is almost inconceivable that anything could occur that would shock business and finance more than did the inception of this great war. The period of panic, of unreasoning fear, is passing, the real dangers are being faced and the problems are being solved. Complete confidence cannot be restored, and business cannot reach a stage of full normal activity in a period of [illegible], or even of a few months, but the [illegible] now in the right direction. Having passed to a stage of greater inaction than current business and financial conditions required, the steel market is in line for a slight recovery, to put it in step with general business."

Faults of Engineers from the Contractor's Viewpoint

Interesting observations bearing upon the relationship of the engineer to the contractor are contained in a paper presented recently before the Albany Society of Civil Engineers, by Mr. Richard W. Sherman, Chief Engineer of the New York State Conservation Commission. The following extracts from this paper are given by our Chicago contemporary, Engineering and Contracting.

Contractors are largely influenced by their opinions of engineers. The engineer who has a reputation for ability, honesty, fairness and good disposition, will attract bidders for any work of which he has charge and the desire to do work under him would be an incentive to reasonably low prices. On the contrary, if contractors consider an engineer incompetent, dishonest, an inebriate or of a cranky disposition, they will often avoid bidding on the work of which he has charge or add to their bids a sum which they hope will cover the excess cost of the work due to the unfavorable attributes in the make-up of the engineer. It is a feature of contracting to "size up" the engineer with as much accuracy as possible, and many contractors become very expert thereat.

In bidding for work, contractors are almost as sensitive as weather vanes. As a rule, they run quite a risk of loss if they bid too low; and the engineer is at least one of the most important features in the situation, as by reason of the characteristics of the engineer it may be possible to make a profit at a given bid under one engineer and impossible to avoid a loss under some other engineer with all conditions, aside from the engineer himself, precisely similar.

Contractors who do not care for the contract often bid fairly high without any expectation of securing the contract, but merely to avoid a reputation among contractors of being low bidders and with the bare chance of getting the work at good prices. Excessively high bids are usually the result of lack of knowledge of the value of the work, lack of time to become familiar with it, and not infrequently from a variety of reasons by which the engineer has been "sized up" so unfavorably by some contractors that they do not want the work under him, are prejudiced against him and the work and consequently unintentionally or otherwise bid too high. The treatment which bidders think they will receive from the engineer if they secure the work is an important feature of the bidding.

If an engineer's preliminary estimate is believed to be too low it drives away bidders and tends to indifferent high bidding. Some over-anxious contractors may be influenced thereby to bid too low. They may secure the work, in which event the engineer has an unpleasant task during construction. There is almost sure to be a disposition on the part of the contractor to save himself from loss, and he is thus tempted to slight or cheat in the quality of the work which the engineer tries to prevent (as he should). The engineer, no matter how fair and just he may be to the contractor, will usually end with a feeling of enmity toward him. Both contractor and engineer are in some degree injured by the work having been done at less than cost. It is detrimental to an engineer to make a practice of making his preliminary estimates higher than the prices at which it is later found the work can be let to reliable parties. On the other hand, great annoyance and trouble and, in most cases, detrimental features which in one way and another causes loss to the owner and detriment to the reputation of the engineer result from making preliminary estimates too low.

In the matter of monthly and final estimates, contractors, particularly those ignorant of engineering, are very prone to suspect that engineers have under-estimated or cheated them. There never has been any good reason why contractors should not check up measurements and quantities even if it is necessary to employ contractors' engineers to do so. In large contracts this has been the custom for some years and is becoming more so. Many more engineers than formerly are engaged in contracting and this feature adds to the practice of contractors measuring and checking up estimates. It is to be hoped that this practice will become general.

Great injustice has been done engineers, as many intelligent contractors know, by the perpetual suspicion that the engineer is under of having cheated contractors. There is seldom a motive other than spite for an engineer to cheat a contractor and the spite cases I believe to be very rare. In small works, for instance, such as village water-works and sewers, some engineers may be tempted to under-estimate in order to keep the cost of the work down to the preliminary estimate or appropriations. I trust there are not many such, but I fear there are some.

An indolent, indifferent engineer and also a procrastinator, are torments to contractors and a cause of considerable unnecessary cost in executing the work.

Copper Alloy for Metal Lath Manufacture

Contributed by Clarence W. Noble

SINCE the first introduction of metal lath, architects and plasterers have known that it is very susceptible to the corrosive effect of hard wall plaster. At first this was not generally appreciated. For this reason many buildings have been erected in which the metal lath was entirely unprotected. The failure of certain early metal lath construction has brought the consequences of such careless specification to the attention of constructors, and as a result there has been given a greater amount of study to the protection of metal lath.

Besides the customary protection of metal lath by coatings there remains another method hitherto untried. This is by changing the composition of the metal itself so that hard wall plaster will have but little effect on it. Of course it would be highly desirable to make the lath of metal of such composition that corrosion would be impossible. This, however, cannot be done except at a prohibitive price. The next best alternative is to reduce the corrosion to such a degree that while the protective coating will still be used the attack at the scratch, should this occur, will have a negligible result.

For a number of months the writer has been experimenting along this line. He is now in a position to announce a specification for metal lath in hard wall plaster which will not increase the price of the material in the slightest and will reduce the corrosion at scratches to 1/15 of its former amount, a quantity which can safely be regarded as negligible. It was also found that this corrosion ceased under normal circumstances within a comparatively short time after the application of the plaster. This improvement will hereafter be adopted in the manufacture of Herringbone Metal Lath.

In the spring of 1913 the attention of the writer was called to the greatly increased resistance to corrosion that could be imparted to steel by the addition to its composition of a small percentage of copper. This alloy is now being manufactured commercially by the United States Steel Corporation. Roughly speaking it will resist the corrosive effect of dilute sulphuric acid about fifty times as long as ordinary steel. Its life when exposed to atmospheric influence is from fifty to seventy-five per cent. greater than the life of steel free from copper. When immersed in a solution of table salt it will last twenty times as long as ordinary steel. These facts led to the hope that in this material might be also found an increased resistance to corrosion arising from hard wall plaster. It was this hope that caused the writer to make his tests.

The tests here described were made by the Canadian Laboratories, Limited, of Toronto. They were supplied with a number of specimens of sheet metal, each one-inch square, both of plain steel and of copper alloy.

These were carefully cleaned of mill scale by pickling them in a weak acid bath. They were then washed with a solution of lime water, followed by pure water, after which they were carefully dried and weighed. After this they were placed in hard wall plaster and stored for the desired time of exposure. Five different brands of plaster were used. In order to secure a uniform result only enough plaster was mixed to bed one specimen at a time. The mixture was done with 40 per cent. by weight of water and the specimen was bedded immediately after mixing. The specimens were stored separately on glass plates and were kept in a saturated atmosphere. The reason for this is that the rate of corrosion is believed to depend to an extent on the amount of moisture that reaches the specimen. Comparable results can only be obtained when all specimens are treated alike, and only a saturated atmosphere can assuredly be kept at a constant humidity. These specimens were therefore kept over a water bath in an enclosed box.

When the time for the examination of the specimens arrived they were cleaned from plaster and washed in ammonium citrate. This chemical is a solvent for rust but makes no attack on steel. After cleaning, the specimens were carefully dried and weighed. The subtraction of the weight after hard wall plaster exposure from that found before exposure gave the loss by corrosion. From this the percentage of loss of original weight was thus readily determined. This percentage of loss instead of actual loss is the figure considered because thus the effect of any variation in the size of the specimen is eliminated.

Tests were made with five different kinds of commercial plaster, two different kinds of steel and five different times of exposure. Three individual tests were made with each combination of time of exposure, a brand of plaster and a kind of steel. Thus a total of seventy-five specimens each of ordinary steel and copper alloy were tested.

The plasters selected for tests are the five most widely-used plasters on the Canadian market. With one exception they are typical hard wall plasters. Their composition is mainly plaster of Paris. With this is a small amount of hair—a retardent to prevent too rapid setting—and, with all except number four, a varying percentage of lime. Plasters number two, three and five are about two-thirds sand. Plaster four was furnished neat, the intention being that the plasterer should mix his own sand. It was tested as furnished. Plaster number one is not properly speaking a hard wall plaster; while plaster of Paris enters into its composition it has about ten times as much retarder as the others and sets so much more slowly. It does not contain sand but in the place of it has a softer and more porous material, the evident intention being to increase its sound-proof qualities.

Although tests were made for five periods varying from one day to ninety days, the following table, made to show the corrosive effect of the different plasters, was made by averaging all times of exposure together.

Average Loss in Grammes by Corrosion with Different Plasters

Plaster	No. 1	No. 2	No. 3	No. 4	No. 5	Aver.
% Lime Content	3.88	6.92	2.00	0 00	1.00	
Plain Steel	2.63	0 47	0.79	1.99	1.66	1.51
Copper Alloy ...	1.43	0.13	0.61	1.66	0.87	0.94

Ratio of average results for each plaster tested
Alloy 1.00 Plain 1.77

Ratio for average for all specimens tested
Alloy 1.00 Plain 1.61

It will be noted that the various plasters differ widely in their corrosive properties. It is also a curious fact that the plasters showing lower rates of corrosion show relatively greater advantage for copper alloy. For example, number two plaster exhibits a rate of corrosion less than that of the others. The ratio of percentage of loss between copper alloy and plain steel in the case of number two plaster is as 1.00 is to 3.62. In the case of number four, the most corrosive hard wall plaster, the ratio is only 1.00 to 1.20. This explains why the average of the ratios by plasters does not check the ratio of the average of all specimens. The former figure is as 1.00 for copper alloy is to 1.77 plain steel, whereas the latter is 1.00 as compared with 1.61.

Plaster number one is apparently more corrosive than the others. On account of its slower rate of setting it holds moisture against the steel for a much longer time than do the other plasters. With this exception the varying rate of corrosion is due apparently to the varying proportion of hydrated lime in the composition of the plaster.

It will be noticed that with this exception, should the plasters be arranged in order of their lime content, they would also be arranged in the order of the vigor of their corrosive attack.

Unless á comparison is made between actual results shown by the different plasters, the full significance of this small varying percentage of hydrated lime is not appreciated. Omitting plaster number one we see that using plain steel, the rate of corrosion is reduced to less than one-quarter of its original amount by the addition of seven per cent. hydrated lime. If copper alloy is used, the addition of seven per cent. hydrated lime reduces the rate of corrosion to nearly one-seventh the original amount. If both copper alloy and hydrated lime are used the rate of the corrosion is less than one-fifteenth of what it would be if neither of these precautions was observed. Finally, as an extreme case, the rate of corrosion of number two plaster with copper alloy is only one-twentieth of the rate of number one plaster and plain steel . These results justify the statement that a specification has been found which will reduce the rate of corrosion at scratched places in the cold japanned protective coating to an insignificant amount.

Number three plaster is tested neat. The other plasters are about two-thirds sand. The fact that number three plaster falls into the place in the diagram that is indicated by its lime content shows that the presence or absence of sand has no effect on the rate of corrosion. If the walls were exposed to condensation from exhaust steam or other similar sources this might not prove to be the case.

Average Loss in Grammes for Different Times of Exposure

Time in days	1	7	14	30	90	Aver.
Plain Steel	0.13	1.24	1.47	1.85	2.74	1.51
Copper Alloy ...	0.07	0.72	0.81	1.52	1.60	0.94

It will be noticed here too that the effect of a decreased rate of corrosion is more apparent in the case of copper alloy that in plain steel. In the former case corrosion practically ceases at the end of thirty days. In plain steel, thirty-two per cent. of the corrosion exhibited at ninety days has taken place after thirty days.

These tests warrant the following conclusions: (1) the addition of hydrated lime up to seven per cent. to hard wall plaster has a marked effect in reducing its corrosive effect on metal lath; (2) the addition of a small pėrcentage of copper to the steel used in making metal lath is more effectual in enabling it to resist corrosion than the addition of fifty per cent. to the thickness of the metal; (3) the combination of seven per cent. hydrated lime with the copper alloy reduces the rate of corrosion to less than one-fifteenth of the rate shown when these precautions are not observed; (4) with metal lath formed from copper alloy corrosion from hard wall plaster ceases in about thirty days; (5) compared with these simple precautions the use of a heavy gauge as a means of resisting corrosion is comparatively inefficient and expensive.

Concrete Roads—Their Design, Specifications and Present Status*

By A. A. Young

(Concluded from last issue)

It is a well-known fact that clay in the aggregate reduces the bonding strength, therefore if the resistance to wear and abrasion is to be high, the aggregate, both large and small must be very clean.

Another feature which points towards the specification of the rich mixtures is the comparative costs of the various mixtures to resist the same load, as is shown in table No. 6.

Table No. 6

1:1 :2	450	2.58	0.33	0.67	26.4	6.31	1.60
1:1½ :3	390	1.88	0.36	0.73	21.7	6.70	1.45
1:2 :4	350	1.48	0.38	0.77	19.7	7.13	1.40
1:2½ :5	300	1.22	0.39	0.79	18.3	7.87	1.44
1:3 :6	240	1.03	0.40	0.80	17.3	9.06	1.57

This table is worked out for a 350 barrel of cement, 30 per cent. voids in both sand and stone and costs are, $2.15 per barrel of cement delivered, $1.75 per cu. yd. sand delivered, $2.25 per cu. yd. stone delivered, and labor at $1.50 per cu. yd.

The column "cost per sq. yd. in $" shows that if we consider—as we should—the strength of the pavement to carry beam loads, there is nothing to be gained by using the lean mixtures. The 1:1½:3 mixture being of the same cost for the same strength as the others in table No. 6, has the advantage of resisting abrasion and wear as is shown in table No. 5.

Even if the rich mixtures are used, undue wear may take place, due to insufficient curing. When laid in such thin slabs, the concrete will dry out before it sets and its power to resist wear will be lost. If the concrete is kept damp for 14 to 21 days the surface will become very hard and also the whole slab will become considerably stronger than if it were left to set up without protection from the heat.

Having a rich mixture properly surfaced and cured we have then to consider the amount the pavement will wear. The tests in table No. 5 subjected every part of the surface to the passing of a heavy traffic wheel two thousand times. That is equivalent to the passing of two thousand heavy wheels in the same track. It would seem, therefore, that for the best mixture a wear of 1/10th to 1/16th of an inch per year in the centre of the road would be a safe allowance. At least one inch should then be added for wear.

2. Specifications

The points in the specifications which need special attention fall under these heads:—grading, drainage, mixing, surfacing, curing, inspection.

Grading

The usual points in a grading specification are:—1, no soft material or spots to be allowed; 2, all roots and sod to be removed; 3, all the filling to be rolled in layers not more than six inches thick.

These points are all important, especially the last, but the following points which are usually omitted, are of even more importance:—

1. That the roller shall roll as much and more on the outside edges of the subgrade as in the centre, the tendency being for the roller to work mostly up and down the central portion of the subgrade.

2. Subgrade to be built at least three feet wider on each side of the pavement at the time the main subgrade is built.

3. Where the pavement is laid upon the old roadbed which has been crowned, the old crown shall be broken up and worked over so as to have an even fill throughout the whole width of the pavement.

If these three points are not insisted upon the road will crack longitudinally.

Drainage

The specifications for drainage of country roads are different from those for cities and towns with sewerage systems.

1. Country roads.

The general drainage along a country road is carried inside ditches, while the edges of the pavement are protected from the surface water shed from the pavement by small trenches placed on each side of the pavement, which are filled with stone or gravel and which have outlets to the side ditches.

The important features are: 1, to have the main ditches on each side of the road deep enough to keep down the water level under the pavement; 2, to have these ditches drain quickly.

2. City and town streets.

1. Where curb and gutter are used on the outside edges of the pavement, the surface water is carried to catch basins and away.

2. The subgrade should be protected against moisture from the edges by putting a narrow trench at least two feet deep under the curb, filling it with a pervious material and draining it to the catch basins also.

The importance of these deep drains to reduce moisture may be realized from the fact that in cities where these drains are run to catch basins, water can be seen trickling in at any time during the summer months. The seepage water can only be kept down by deep drains and the surface water must be quickly disposed of.

Mixture

The outstanding features in mixing are: 1, the ingredients must be clean; 2, the proportions must be accurately measured; 3, the coarse aggregate shall have a predominance of the large sizes 1 to 1½ inches; 4, the materials shall have no soft or flat particles; 5, the fine aggregate shall be free from fine particles; not more than 10 per cent. to go through a 50-mesh sieve. The fine aggregate shall also be tested for tensile strength; 6, the aggregates must be separately measured; 7, the mixture should be 1:1½:3 or 1:2:3; 8, the amount of water should be enough to give a pasty and not a sloppy mass. (This prevents the separation of the coarse aggregate from the mortar in placing) 9, all the materials shall be at least 45 seconds in the mixer drum before any is discharged; 10, the subgrade shall be sprinkled just before the concrete is placed so it will not absorb moisture from the concrete; 11, enough labor shall be put on to work the concrete sufficiently after it is dumped to ensure an even distribution of the coarse aggregate in the mortar.

Surfacing.—Great care shall be taken in finishing that the surface be made even. The surface is usually struck off with a template the shape of the crown. This template is worked back and forward in a short saw motion across the road, and at the same time, along the road. This leaves small marks or ridges on the surface which are trowelled over with a wooden float. If the surfacing with the template is done two or three times, the trowelling will easily give an even surface. If the surface is uneven the traffic will have a tendency to pound and produce holes.

Curing.—As soon as the concrete has set enough as not to be disturbed, it should be sprinkled and covered with canvas or clay. This covering of clay is made two or three inches thick and is kept damp for the whole period of curing, which is 7 to 14 days. The longer it is sprinkled and cured, the harder will be the surface. The dampness also helps to equalize the contraction due to setting and reduces the initial stresses in the slabs.

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*Paper read before the Manitoba Branch of the Canadian Society of Civil Engineers.

Inspection.—The overlooking of any one of these main points of the specification in a concrete pavement will result in part failure of the road. The majority of these requirements appear in almost any specification for concrete and a great many of them are interpreted as of little importance. This is probably due to the fact that the concrete in almost all cases is only called upon to carry compression. It has been clearly demonstrated in this discussion that in road work, concrete is made to carry beam loads, and is therefore subject to tensile stresses so that its use for this purpose demands a far more rigid inspection and enforcement of the details of the specification.

The materials should all be examined as to sizes and enough tests should be made to be certain of their strength and of the absence of clay. This should be done before the materials have been distributed along the road. In fact, a much better method is to have a careful examination made of the source of supply and then more examination by eye at the cars to see that the material received is that which was passed at the source of supply.

The grading and rolling require rigid inspection, a thing which they very rarely receive. The requirement of rolling in 6-inch layers and rolling equally well at the sides and centre should be enforced, also the breaking up of the old road crowns.

Too much stress cannot be laid on the inspection and a paving contract of any magnitude should have at least: 1. One engineer competent to inspect materials and look after the grading, and, 2. An assistant inspector at every mixer working.

Some may consider that this would cause strained relations with the contractor. It need not if the contractor is made to realize at the time of bidding that all the details in the specification will be enforced. This is only fair to the contractor and although his price would be a little higher, it would result in the inspection department and the contractor working together to make as good a job as possible. After all it is very difficult to get more than we pay for and a poor concrete road is expensive when its total cost per year is considered.

3. Present Status of Concrete Roads

The cost of a pavement is usually met by the selling of debentures. The term of these debentures should not be more than the estimated life of the pavement. The cost of the pavement per year will then be: 1, the sum set aside yearly as a sinking fund; 2, interest on the debentures; 3, the maintenance of the pavement.

In selecting a type of pavement, these three points are usually given a standard percentage value of 44 or 45 per cent, as will be seen from the following:

Table No. 7

Cheapness	14
Durability	20
Cost of maintenance	10
Ease of cleaning	13
Low traction resistance	14
Sanitary qualities	13
Non-slipperiness	7
Favorableness to travel	4
Noise, light, heat	4
	100

These values will vary a little in different locations, but care should be taken not to let the personal interest of a few property holders or residents make changes in the values. A good concrete road built along the line of the above specification and design is not a cheap road. Its cost here runs from two-thirds to three-quarters the cost of the ordinary forms of asphaltic pavements. The life of this high specification road should be at least 20 years with very low maintenance charges. It is easily cleaned, is sanitary, has a very low traction resistance and is not slippery. The worst features, those of noise and reflection of heat and light receive very small percentage values in the foregoing table, which is the same as that used in two of the most recent books on pavements.

Concrete as a pavement is used to-day: 1, on country roads; 2, streets in towns; 3, lanes in large cities; 4, streets of moderate traffic in cities.

It is probably not rated as highly as the preceding remarks would indicate, but the specifications have not been so high until the last year or so.

As engineers realize more and more that the only economical method is one which is based on higher specifications and careful designing, and as the knowledge of how to carry out these specifications increases, the rating of concrete as a pavement will rise and its use will become more general.

The Fourth American Road Congress

The fourth American Road Congress held in Atlanta, Ga., last month, is claimed by the United States press to have been the greatest good roads meeting ever held in any country in the world. The convention was held under the direction of the American Highway Association, the American Automobile Association and many other national and state bodies. The actual registration numbered more than three thousand.

Mr. Austin B. Fletcher, President of the Congress, who is also State Highway Engineer of California, called attention in his opening address to the fact that the purposes of the American Road Congress were to bring about better legislation, better financing of road construction and maintenance, better methods of construction and maintenance, better regulation of traffic and a careful study of the possibilities of convict labor for road improvement.

Mr. Logan Waller Page, President of the American Highway Association, and Director of the United States Office of Public Roads, pointed to the fact that during 1914 more than 18,000 miles of hard surfaced roads had been constructed in the United States—more than three-fourths the length of the entire national road system of France. He urged that greater efficiency be sought and he believed it possible to save from the annual expenditure now reaching more than $205,000,000 a year at least 25 per cent., or $50,000,000, through efficient management. An exceptionally large number of men eminent as highway engineers presented in keen analytical papers the different problems connected with the building and maintenance of roads. Among these were notable papers by Henry G. Shirley, Chief Engineer of Maryland, on Heavy Traffic Roads; by S. Percy Hooker, State Superintendent of Highways of New Hampshire, on Light Traffic Roads; by Col. Wm. D. Sohier, Chairman, Massachusetts Highway Commission, on Maintenance of Surfaced Roads; by Austin B. Fletcher, State Highway Engineer of California, on Rights of Way; and by Henry W. Durham, Chief Engineer of Highways, New York City, on Street Construction and Maintenance.

Erratum.—In an article relating to the [illegible] plant of the Canada Cement Company published in our issue of November 11, a statement was made that the steel work was fabricated by the Canadian Structural Steel Company. Also that the steel for the Power House, amounting to about 150 tons, was furnished by the Structural Steel Company, Limited, of Montreal. We are advised that there is no connection whatever between the two companies.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The erection of a Collegiate Institute at a cost of $125,000 is under discussion at Guelph, Ont.

At Toronto, last week, a permit was issued to the Excelsior Insurance Company for a brick and stone building estimated to cost $100,000.

The Westlake Brick & Products Company, Limited, Wellington, Ont., has been incorporated with a capital of $250,000.

Plans are being prepared for a dry dock which is to be built at Halifax at a cost of $3,000,000. The dimensions of the dock will be 1,150 ft. long by 180 ft. wide.

The Dominion Public Works Department is preparing plans for a new drydock at Halifax. The structure will be 1,150 ft. long and 180 ft. wide, and will cost $3,000,000.

Mr. E. A. Wallberg, Toronto, is negotiating with the City Council for permission to build a street railway line 4½ miles long from Leaside to Merton Avenue in North Toronto.

Options are reported to have been secured on two sites at Owen Sound for the erection of a drydock. A bonus of $200,000 was voted toward the enterprise last summer. The project is estimated to cost $1,500,000.

New paving work at Quebec, for which plans have been prepared, is estimated to cost $180,000. The work is in sections of St. Louis and St. Foye Roads. The engineer in charge is Mr. W. D. Baillarge, of Quebec.

The Canadian Inspection and Testing Laboratories, Limited, Montreal, and the Mannesmann Tube Company, Limited, Montreal, have been licensed as extra-provincial companies to carry on business in British Columbia.

The Polish Catholics of West Toronto have purchased a site for a new church on Davenport Road. It is proposed to erect a building next spring. Rev. Father Boyarcynk is in charge of the parish, which is newly organized.

Operations are to commence at once by day labor on the extension of the Quebec water-works, which is to be undertaken at a cost of $120,000. The scheme is to be carried out under the supervision of Mr. T. A. Jardine Forrester.

Sir Adam Beck gave an illustrated address on the work of the Hydro-electric Power Commission, at a meeting of the Engineering Society of the Faculty of Applied Science, held in Convocation Hall, Toronto, on Wednesday, November 18.

The contract has been awarded for the new steel and concrete bridge which the Provincial Government of Quebec is to erect between St. Johns and Iberville, at a cost of $175,000. The general contractors are Messrs. Laurin & Leitch, Montreal.

Mr. T. Aird Murray, consulting engineer, Toronto, has been instructed to prepare plans and specifications for the construction of an up-to-date filtration plant, sewerage and disposal systems for Mimico. The initial cost is estimated at about $125,000.

At Montreal, the R. C. parish of St. Patrick is building an assembly hall on Dorchester Street at a cost of $135,000. The building, which was designed by Mr. J. P. Hynes, and for which Messrs. John Quinlan & Company were the general contractors, is practically completed.

The plant of Armstrong, Whitworth of Canada, Limited, at Longueuil, P.Q., will be in full operation early this month. The company will manufacture high speed steel and also tools, while next year the company will make drop forgings. Mr. W. Furniss Clarke is the superintendent.

Messrs. M. Beatty & Sons, Limited, Welland, Ont., have opened a district office in Toronto at the Builders' Exchange, 154 Simcoe Street. Their representative is Mr. K. McKee, formerly of Welland. Latterly Messrs. Beatty & Sons have been represented by Messrs. H. W. Petrie, Limited.

Mr. John Grieve has been appointed in charge of the Montreal office of the Dominion Paint Works, Limited, of Walkerville, with office in the Eastern Townships Bank Building. Mr. Grieve will look after their interests in the provinces of Quebec, New Brunswick and Nova Scotia.

The new office building which the Liverpool, London & Globe Insurance Company is erecting at Montreal at a cost of $175,000 is rapidly nearing completion. The architects are Messrs. Nobbs & Hyde, and the general contractors Messrs. E. G. M. Cape Company, both Montreal firms.

The fire which occurred recently at the new factory which the Canadian Kodak Company is building at Mount Dennis, Ont., at a cost of $500,000, caused damage estimated at $25,000. As a consequence a considerable number of laborers were laid off temporarily, but work has now resumed.

Building operations are reported brisk at Amherst, N.S. During the last few months some sixty new residences, mostly of a superior type of construction, have been erected. These, with the Goodwin block and the Armoury building, will bring the total expenditure to quite a respectable figure by the end of the year.

The Old Peoples' Home at St. Laurent (Montreal) has reached the roofing stage. The building, which is three-storeys high, of reinforced concrete construction, has been erected by the Atlas Construction Company according to the design of Mr. A. Piche. Work will be continued throughout the winter. The total expenditure is $250,000.

At Quebec, operations are proceeding on the new post office which is being erected by the Dominion Government at a cost of $500,000. Plans were prepared by A. R. Decary, and the architect in charge is Mr. E. M. Talbot. Louis Boivin is the general contractor. The building is to be six storeys high, of stone, reinforced concrete and terra cotta construction.

Mr. A. D. Swan, of Montreal, the former assistant harbor engineer, is in England, and will give evidence for the Bristol Corporation in a legal case involving about $1,000,000. Mr. Swan was on the harbor engineering staff of the Bristol Corporation prior to coming to Canada. Since leaving the Montreal Harbor Commission he has been engaged in practice in Montreal as consulting engineer.

An estimate of the cost of raising Grand Trunk tracks in the city limits is included in a report presented to the Montreal City Council. The estimate is that of the company and totals $8,211,000. It is made up of the revised estimate of $5,903,745 with the addition of the following percentages: for general expenses and contingencies, 5 per cent.; for interest on cost of construction for two years, 6 per cent.; consequential damages, $500,000; commission for financing, 3 per cent. The engineering questions involved are now under study by Mr. G. R. Macleod, city engineer on railways and bridges. Mr. Macleod is engaged chiefly in checking the estimates and determining how far expenditure has been entailed by changes asked by the city.

Mr. B. P. Richardson, late superintendent for Messrs. Ross & Macdonald, of Montreal, has opened an office at 54a Beaver Hall Hill, Montreal, with agencies for hydraulic and municipal engineering supplies. Mr. Richardson, who has had twenty years' experience in different parts of the world, represents several well-known firms and is now equipped to give quotations to city engineers and others.

Mr. T. J. Kennedy, of Sault St. Marie, Ont., president of the Superior Construction Company, Limited, is a man of many parts. He is actually president and general manager of no less than six companies in addition to the office he holds in the construction company. To enumerate these there are the Algoma Central and Hudson Bay Railway, the Algoma Eastern Railway, Algoma Central Terminals, Limited, Algoma Eastern Terminals, Limited, the Superior Rolling Stock Company, Limited, and the British American Express Company, Limited. Mr. Kennedy also holds office in nearly half a dozen other firms. Born at Campbellford, Mr. Kennedy was educated at Port Hope, Ont. Early in life, in 1874, he entered the service of the Engineering Department of the Canadian Pacific Railway, under Sir Sanford Fleming. A few years later he was engineer for the contractors for Section B of the C. P. R. Through the succeeding years he has advanced through various stages to the many important offices that he now holds.

WESTERN CANADA

The Safety First Air Brake Company (Canada), Limited, Victoria, B.C., has been incorporated with a capital of $300,000.

Mr. J. L. Harrington, Kansas City, delivered an address on bridge work at a recent meeting of the Victoria Branch of the Canadian Society of Civil Engineers.

At Medicine Hat a new factory built for the Saskatchewan Iron & Bridge Works has been completed at a cost of $100,000. Machinery has not yet been installed.

At Winnipeg, Fred W. Leistikow is said to have invested $100,000 in the Happyland subdivision, with a view to erecting dwellings valued at $6,000 each. His total investment will be [illegible]

A Strauss lift bridge was put into operation recently across the Fraser at Fort George. This bridge is 2,654 feet long and required 6,500 tons of steel in its construction. The structure entailed an expenditure of about $1,500,000.

Plans for the second unit of the plant which is to be erected at North Vancouver at a cost of $5,000,000 by the Dominion Shipbuilding and Drydock Company, Limited, have been sent to Ottawa for approval. It is intended that constructional operations shall be started in a few weeks.

Good progress is being made with the erection of machine shops and roundhouse for the Grand Trunk Pacific at Prince George, B.C. This district is showing rapid growth and it is probable that there is no other locality in British Columbia in which greater building activity is taking place. During the last three months there have been completed nearly [illegible] worth of new residences and business blocks, while at the present time there are buildings valued at $250,000 under construction.

Progress on the Kettle Valley Railway is so advanced that the line will probably be ready for traffic to the Coast next summer. The Kootenay Central Railway, another branch of the C. P. R. in British Columbia is also well on the way to completion, the Swing Bridge over the Columbia River, near Lake Windermere, having been put into position. Construction on this line has been carried on both northwards from the Crow's Nest Line and southwards from Golden, and this bridging of the Columbia River will enable the two ends to meet.

Clay Products Men to Convene Next Month

THE annual convention of the Canadian National Clay Products Association is to be held January 26-28 next, at the King Edward Hotel, Toronto. An attractive programme has been prepared and a record meeting is anticipated. The President of the Association is Mr. Chas. A. Millar, Toronto, well known as a contributor to this journal; the First Vice-President is Mr. Henry Stevens, Portage la Prairie; the Second Vice-President is Mr. John S. McCannel, Milton, Ont; the Third Vice-President is Mr. J. Edward Frid, of Hamilton, and the Secretary-Treasurer is Mr. Gordon Keith, of Toronto. Among those scheduled to deliver papers are Professor M. B. Baker, Queen's University, Kingston; Dr. A. C. McKay, Principal, Toronto Technical Schools; Mr. A. F. Greaves-Walker, Ceramic Engineer, Manager of the Sun Brick Company, Toronto; Mr. E. W. Knapp, Ceramic Engineer, with the Sun Brick Company, Toronto; Mr. W. W. Smith, Shallow Lake, Ont., and Mr. Andrew Kruson, of the Sun Brick Company. The opening session will be held at 10 a.m. on Tuesday, January 26, when members will register and secure banquet and theatre tickets at the King Edward Hotel. The convention proper will open at 2.30 p.m., when the visitors will probably receive an official welcome from prominent civic officials. In the evening the convention will be entertained at one of the local theatres by the Entertainment Committee. On the second day of the convention, Wednesday, January 27, there will be morning and afternoon sessions devoted to papers and discussions. A smoking concert will be held in the evening. The closing date is Thursday, January 28, when the day will be occupied by papers and discussions and the business of the Association, the whole proceedings being brought to a close in the evening by a banquet. It is hoped that every manufacturer of clay products in the country will make an effort to attend. Interesting features are being taken with a view to making the convention the most successful in the history of the Association and the co-operation of the trade is solicited to this end.

Mr. Chas. A. Millar, President of the Canadian National Clay Products Association.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.

Operations have started on the construction of a Park Drive, 20 ft. to 40 ft. wide and 50,000 cu. yds. of embankment, for this city. Work is being carried out by day labor under the supervision of Mr. T. Harry Jones, City Engineer. Bridge over Hydraulic Canal will not be started this year. Mr. F. Cockshutt is Secretary, Parks Board.

Cochrane, Alta.

The municipality of Cochrane has in contemplation the installation of a waterworks system next year. Mr. J. E. Laird is secretary-treasurer.

Calgary, Alta.

The Weno Power & Light Company has applied for permission to lay water and gas mains and to construct transmission lines for electric power in sections 10 to 16, Township 24, Range 29, Section 18, and Township 24, Range 28, Alberta. Messrs. Griffiths, Ford, Wright & Miller, of Calgary, are the firm's solicitors.

Galt, Ont.

The Town Council is laying about one mile of 10-in. water mains on macadamized road and 1,200 ft. of 18-in. water mains on Water Street South. The latter work will be done this winter. Pipe has not yet been purchased. Canadian manufacturers have been asked to submit new prices. Mr. Jas. McCartney is the town clerk. The estimated cost of additional waterworks system is $55,000.

Hamilton, Ont.

Estimates will be prepared and reports made by Messrs. Kerry & Chace, Confederation Life Building, Toronto, engineers, in connection with new reservoir to be erected on Mountain Top for the Board of Control.

Tenders for pump house and pumps in connection with sewerage scheme in east end, estimated to cost $130,000, will not be called until next summer by the Board of Control. A quantity of cement, broken stone and reinforced steel will be required. Trenching work has been started by day labor. Mr. A. F. Macallum, City Hall, is the engineer.

Morris Township, Ont.

The Township Council here have decided to construct a number of tile drains in the township. Mr. Alex. McEwen, Bluevale, is township clerk.

Mimico, Ont. (Toronto)

Work is expected to start as soon as debentures have been sold, on the construction of a water and sewerage system here at an estimated initial outlay of $125,000. Plans now being prepared will be submitted to the Village Council before work is proceeded with. Mr. T. Aird Murray is consulting engineer.

Niagara Falls, Ont.

Surveys have been made preparatory to the construction of sewers on Queen and Bamfield streets at an estimated cost of $3,000 for the City Council. Work, which will consist of enlarging Queen Street sewer and laying new sewer on Bamfield Street, is to be done by day labor under the supervision of the engineer, Mr. F. J. Anderson.

New Westminster, B.C.

The Board of Works has been authorized to proceed at once with the construction of a new reservoir here. Work will be done by day labor. Mr. J. W. B. Blackman is engineer.

Ottawa, Ont.

Work will start immediately on the laying of a tile pipe sewer between the G. T. R. and Carling Avenue. Solid rock excavation will be necessary. Work is to be done by day labor. Mr. R. L. Haycock is engineer-in-charge.

Ottawa South, Ont.

By-law will be voted on by ratepayers next January for the construction of intercepting sewer in Ottawa South district for City Council.

Preston, Ont.

The construction of pavements on Waterloo, Queen, Hamilton, Argyle and Duke Streets, is contemplated by the City Council. The city clerk is Mr. H. C. Edgar.

Port Dalhousie, Ont.

The Village Council has under way arrangements for the laying of a watermain connected with St. Catharines water system for the purpose of supplying Port Dalhousie with water. Mr. J. M. A. Waugh is village clerk.

Point Grey, B.C.

Tenders will be received by Mr. G. G. Heighway, Kerrisdale P. O., until December 7th, for paving Fourth Avenue from Alma Road to Blancha Street, at an estimated cost of $50,000. Plans and specification are with the town engineer, Town Hall.

Quebec, Que.

Plans have been drawn for paving work at an estimated cost of $27,000 from St. Valier Street to City limits. Mr. W. D. Baillarge, City Hall, is engineer-in-charge.

Toronto, Ont.

Tenders are invited by the Board of Control for the following materials: brass and bronze castings; brass work for house services; cast iron pipe; hydrants; lead pipe; special castings; stop valves. Plans, etc., at Room 12, City Hall.

Vancouver, B.C.

Plans are in progress upon the completion of which work will be started on the construction of "Clark Drive" trunk sewer, estimated to cost $325,000, for the Vancouver and District Joint Sewerage and Drainage Board, 718 Granville Street. It has not yet been decided whether to let the contract or to do the work by day labor. The company's engineer has charge of the work.

West Vancouver, B.C.

Plans have been prepared by Mr. H. McPherson, Hollyburn, engineer, for a waterworks system estimated to cost $150,000 for the Municipal Council. The source of the supply is to be the head of Sister's Creek where dam 26 ft. high and 10 ft. long will be constructed. Operations are to begin in January.

Winnipeg, Man.

A by-law is to be voted on for the laying of sewers on a number of streets. Work is to be done by day labor and will be carried through this winter. Mr. W. P. Brereton, 223 James Avenue, Winnipeg, is the City Engineer.

CONTRACTS AWARDED

New Westminster, B.C.

The tender of the British Columbia Transport Company has been accepted by the Board of Works for the supply of 4-in. and 6-in. vitrified sewer pipe in connection with the city's water supply scheme.

Toronto, Ont.

York Twp. Council has awarded to Mr. J. C. Scott, Lambton Mills, Ont., the general contract to construct sewers on Glenholme and Earnscliffe Avenues, estimated to cost approximately $20,000. Mr. Frank Barber, 57 Adelaide Street East, is the engineer.

Board of Control (Commissioner of Works, Mr. R. C. Harris), has let the contract for supply of pipe and laying of 72-in. conduit in connection with pumping and filtration plant at Toronto Island, to Messrs. Roger Miller & Sons, Limited, Toronto.

The following contracts for sewer construction in this city have been let by the Board of Control (Mr. R. C. Harris, Commissioner of Works): Provincial Contracting Company, Bingham, $2,987, Kingswood, $1,310; McKnight Construction Company—Eastern, $3,844, Swanswick, $4,982; Mr. W. E. Taylor—Wheeler Avenue, $1,343; Mr. M. H. Murphy—Victoria Avenue, $3,952; Asphaltic Concreting Company—Medland, $315; Commissioner of Works, City Hall—Alton Section, $8,750. Tenders for Evans Avenue have been referred to Commissioner for report.

Watford, Ont.

The contract for repairing Kent drain has been awarded by the Village Council to Mr. Thos. E. Corbett, Forest, Ont. Mr. B. B. Dann is the village clerk.

Railroads, Bridges and Wharves

Brockville, Ont.
Work has not yet started on the construction of a concrete bridge near Brockville for Counties of Leeds and Granville. Mr. Blackwell is the County Engineer.

Champlain County, Que.
The C. P. R. is to construct a siding for the Wayagamack Pulp & Paper Company, Limited, on Bellerive Island.

Edmonton, Alta.
The Edmonton Northwestern Radial Railway Company, Edmonton, has applied for a charter to construct an inter-urban railway stretching from Edmonton northwest to the Pembina River. Messrs. Short, Woods, Bigger & Collison, 14 Howard Avenue, Edmonton, are said to be interested in the project.

Fort William, Ont.
The G. T. R. will construct a siding across Heath Street and along Montreal Street, to serve Messrs. N. M. Patterson & Company.

Kingston, Ont.
The Board of Works will receive tenders until December 3 for the construction of a breakwater at an estimated cost of $30,000. Plans and specification are at office of city engineer, Mr. R. J McClelland.

Lac du Bonnet, Man. (Winnipeg)
The Fire, Light & Water Department of the Board of Control, is contemplating the erection of a steel bridge across the Winnipeg River. Mr. W. P. Brereton, 223 James Avenue, Winnipeg, is the engineer.

Ottawa, Ont.
A siding into the premises of Library [illegible] of Canada Limited, [illegible] of Isabella Street, will be constructed by the G. T. R.

[illegible] will be received [illegible] by the Commissioners of the Transcontinental Railway [illegible] for the supply of 150,000 ties to be delivered at Belair and LaTuque, Quebec. Specification, etc., may be seen at office of Mr. Gordon Grant, chief engineer, and Mr. A. E. Doucet, district engineer, Quebec, Que. Mr. P. E. Ryan, [illegible].

St. Johns, Que.
Tenders for steel work on [illegible] bridge to be erected here for the Provincial Government Department of Public Works, will be called shortly by the general contractors, [illegible], Beaver Hall Square, Montreal. Other work will be done by the general contractors during winter. Bridge will be steel and concrete construction, 25 ft. wide and will be erected between St. Johns and Iberville. Mr. Baulue Mercier, 137 McGill Street, Montreal, is the engineer.

St. Gabriel, Que.
Two spur lines for Mr. J. [illegible], St. Gabriel, sub-division Montreal, will be constructed by the C. P. R.

Toronto, Ont.
The Board of Control has been requested by a deputation to consider plans for extension of civic car line south on Lansdowne and Bathurst Street from St. Clair Avenue.

Mr. E. A. Wallberg, 10 Adelaide St. E., owner and engineer, is negotiating with the City Council for permission to build a car line 4½ miles long, from Leaside to Merton Avenue, North Toronto. Owner will buy all material and will superintend construction. Estimated cost of line $200,000.

Public Buildings, Churches and Schools

Antigonish, N.S.
The construction of a dormitory for St. Francois Xavier College, St. Ninian Street, will be superintended by the architect, Mr. Neil McNeil, care McNeil Bros., Boston. Building will be four storeys and basement, brick and stone construction, 72 rooms. It will be completed by September, 1915.

Atwood, Ont.
The Methodist Church Congregation are contemplating the erection of a $5,000 church here, white brick construction. The architect has not yet been appointed. Rev. Jas. Husser, is the pastor.

Bellis, Alta.
Bellis School District No. 3185, just organized, have decided to erect a school building here. Mr. Paul Dundra, Bellis, is a trustee.

Bow Island, Alta.
The Baycroft School District No. 3103 has been authorized to obtain funds to erect and equip a school building here. Mr. Geo. Evans, Bow Island, is a trustee.

Durham, Ont.
Plans and specifications are at office of secretary-treasurer, Mr. J. W. Vickers, Durham, who will receive tenders until December 10th for the erection of a school building for School Section No. 3, Bentinck. Work will be started next spring.

Dysart, Sask.
A small school will be built and school equipment purchased by the Radant School District No. 3474. Mr. John Brodner, Dysart, is a trustee.

Fairacres, Alta.
Lawndale School District No. 3099 (Mr. O. M. Olson, Fairacres, trustee), have been authorized by the Provincial Government to erect and equip a school building here.

Fort Frances, Ont.
The Municipality of Alberton will invite tenders next spring for contract to erect public hall on Trunk Road, Crozier Twp. Estimated cost $1,200. Mr. F. H. Warner, Fort Frances, is the clerk. Architect has not yet been appointed.

Griffin, Sask.
Equipment will be required for a new school building to be erected shortly for the Carnation School District No. 3470. Mr. F. G. Connor, Griffin, is school trustee.

Grand River, Que.
Tenders close with Rev. Jos. E. Ouellet, parish of Notre Dame de Grand River, on December 12th for remodelling old wooden church. Plans and specification are at office of the architect, Mr. Thos. Raymond, 45 Caron St., Quebec. New building will be 45 x 110, brick and frame construction, concrete foundation.

Tenders will be received until December 12th by Rev. Jos. E. Ouellet for enlargement to Catholic church, Gaspe County. Scotch bricks for casing will be required. Plans and specification are at office of architect, Mr. Thomas Raymond, 45 Caron Street, Quebec. Building will be frame construction.

Halifax, N.S.
Repairs to the Church of England Institute, Burlington Street, including new roof, brick work and interior woodwork, are being carried out under the supervision of the architect, Mr. R. A. Johnson, 56 Barrington Street. Repairs, consisting of three-storey building, felt and gravel roofing, are estimated to cost $3,500.

Hamilton, Ont.
Interior fittings will be purchased by the architects, Messrs. Stewart & Witton, Hamilton Prov. and Loan Building, in connection with the construction of bank and apartments on James Street North for the Molsons Bank. All sub-contracts have been let. Building is three storeys, 67 x 24.

Ingersoll, Ont.
The erection of a Sunday-School building is contemplated by the Methodist Congregation at Ingersoll. The building will probably be white brick construction. The architect has not yet been appointed. Rev. L. G. Hill is the pastor.

Lambton, Ont. (Toronto)
The construction of a school building here is contemplated by school section No. 33, York, trustees of which are Messrs. A. Shaw, J. Ellis and J. Carson, all of Lambton, Ont.

Mellowdale, Alta.
The Bloombury School District No. 3186 which was organized recently, has the erection of a school in contemplation. Mr. J. M. Johnson, Mellowdale is a trustee.

McLeod Valley, Alta.
A school building will be erected in the near future by the Beaver Meadow School District No. 3187. Mr. H. J Hellekson, McLeod Valley, is a trustee

Montreal, Que.
Sub-contracts for electrical work and interior fittings have not yet been let in connection with new bank and office building on St. Lawrence and Ontario Streets for Molsons Bank, 200 St. James Street. Messrs. Turner & Carless, 19 Beaver Hall Hill, are the architects. Mr. J. H. Hutchison, 64 St. Ambrose Street, is the general contractor.

Moncton, N.B.
Central Methodist Church building has been burned down, involving a loss estimated at [illegible]. Insurance [illegible].

Meacham, Sask.
The erection of a school building is receiving consideration from the Meach-

[illegible] School District No. 3469 (Mr. Duncan Murray, Meacham, trustee). School equipment will be required.

Province of Saskatchewan
The Poutrilas School District No. 3280 (Treasurer, Mr. Edward Mettinson, Nipawin), and the Imperial Village School District No. 559 (Treasurer, Mr. W. J. Rodman, Imperial), have been empowered to borrow funds for the erection of a small school and the provision of school equipment.

Peers, Alta.
Shining Bank Hill School District No. [illegible] has decided to erect a school building here and also to purchase equipment. Mr. H. B. McKenzie, Peers, is a trustee.

Renown, Sask.
The Provincial School District No. 3472 contemplates the construction of a school building here. Equipment will also be purchased. Mr. Samuel Thompson, Renown, is a trustee.

Regina, Sask.
Tenders for interior fittings will be invited shortly in connection with four-storey, stone and brick addition to hospital for the Hospital Board. Messrs. R. L. Lecky & Company, Limited, 304 Northern Crown Bank Building, are the general contractors. Mr. R. N. Darrach Weston, Trust Building, is the architect.

Rocky Mountain House, Alta.
The Isojoki School District, No. 3184, will erect a school building in the near future, when equipment will be required. Mr. W. A. Standinger, Rocky Mountain House, is a trustee.

Swift Current, Sask.
Tenders for roofing, plastering and painting will be called next spring in connection with $103,000 court house for the Provincial Government Department of Public Works. The building will be two-storey, 100 x 75 ft., stone, brick, fireproof and reinforced concrete construction. Messrs. R. J. Lecky Company, Limited, 304 Northern Crown Bank Building, Regina, are the general contractors.

Summercove, Sask.
The Return School District No. 3473 (Trustee, Mr. Charles Swanson, Summercove), has in contemplation the erection of a school building and the purchase of equipment. The school district was only formed recently.

St. Laurent, Que. (Montreal)
It is announced that work will be continued throughout the winter on the construction of $250,000 Old Peoples' Home for Grey Nuns, Guy and Dorchester Streets. The building will be three-storey, 200 x 80, reinforced concrete construction. Mr. A. Piche, 33 Belmont Street, is the architect. Atlas Construction Company, Montreal, have the general contract.

Tripola, Alta.
The Odien School District, No. 3182, have decided to raise funds to erect and equip a school building here. One of the trustees is Mr. F. Bishop, Tripola.

Toronto, Ont.
Funds are being raised by the Ebenezer Methodist Congregation for the purpose of erecting a church on Caledonia Street.

The Hibernian Hall Association, Limited, which was incorporated recently with a capital of $10,000, are contemplating the construction of a hall next year. Mr. V. W. McCarthy, 84 O'Hara Avenue, is the secretary.

Tenders will be received until December 11 for power plant consisting of steam engines, generators, switchboards, steam piping and electrical connections, in connection with the new technical school for Board of Education. Plans and specification are at office of consulting engineers, Canadian Domestic Engineering Company, Limited, Toronto.

Twin Butte, Alta.
The Spread Eagle School District No. 3183, is erecting a school building here. Equipment will be purchased. Mr. F. F. Alfred, Twin Butte, is a trustee.

Vermillion, Alta.
The Owlseye Lake School District, No. 3181, (Mr. H. R. Parker, Vermillion, trustee), have in contemplation the erection of a school building and purchase of equipment.

Vancouver, B.C.
Tenders will be invited shortly by the secretary, School Board, Mr. Girard Upton, for the erection of an iron rail fence around Beaconsfield School, 20th Avenue.

Weston, Ont. (Toronto)
The Building Committee has received 18 designs for new Masonic temple to be erected here at an estimated cost of $12,000 for Mr. C. Lorne Fraser (in trust), Main Street, Weston. A selection will not be made by committee for some time.

CONTRACTS AWARDED

Guelph, Ont.
The following contracts have been let for alterations to Dublin Street Methodist Church building at a cost of $6,000: carpentry, Sheppard & Hicks, Guelph; seating, Valley City Seating Company, Dundas; Mr. W. A. Mahoney, Telephone Building, is the architect.

Vancouver, B.C.
The General Hospital Board (managing secretary Mr. Geo. Haddon), has awarded the general contract to construct a morgue building at a cost of $5,215, to W. J. Smith Limited, Bank of Ottawa Building.

West Point Grey, B.C.
Contracts have been awarded as follows for $50,000 school building on University Avenue and Trimble Street for School Board:—Heating and temperature control, Kydd Bros., Vancouver, at $5,028; plumbing, $2,121; ventilating, $1,251, Orr Bros., Vancouver. Mr. D. Davies, 614 Hastings Street W., Vancouver, was given the general contract at $39,050. Building will contain 15 rooms and will be 100 x 92 ft., reinforced concrete construction. Messrs. Twizell & Twizell, 1019 Metropolitan Building, Vancouver, are the architects.

Business Buildings and Industrial Plants

Aylmer, Ont.
The remodelling of a warehouse is contemplated by Mr. Frank Trim. New flooring, joints, supports, etc., are required.

Barrie, Ont.
Interior fittings for $12,000 residence on Kempemfeldt Street for Mr. D. M. Stewart will be supplied by the architect, Mr. P. C. Palin, Hurontario Street.

Sub-contracts for plastering, painting, plumbing, heating and electrical work have not yet been let in connection with the erection of an $8,000 store and apartments, two-storey, 34 x 60, brick construction, for Mr. D. Waisberg, 106 Dunlop Street. Bell Planing Mill, Bayfield Street, have the general contract. Mr. E. G. Strathy, 123 Simcoe Street, Toronto, is the architect.

Belleville, Ont.
The Balmoral Hotel (proprietors, Johnson & Bottum), has been destroyed by fire, involving a loss estimated at $7,000. Restaurant and confectionery store owned by Mr. J. B. Black has also been destroyed.

Blenheim Twp., Ont.
Farm buildings estimated to cost $4,000, are contemplated by Mr. Robert Wilson, Con. 5, Blenheim Twp., Princeton P. O. Building will be fireproof construction, concrete foundation, roofing and flooring to be selected.

Buctouche, N.B.
The Moncton & Buctouche Railway are contemplating the rebuilding next spring of a station and freight sheds. Mr. E. G. Evans, Buctouche, is the superintendent.

Cardston, Alta.
The Ellison Milling Company, Raymond, Alta., has purchased the Cardston Milling Company's plant. It is the intention to enlarge and remodel the flour mill. Mr. Jas. E. Ellison, Cardston, is the president.

Comaplix, B.C.
The saw and planing mill of the Forest Mills of British Columbia, Limited, Revelstoke, B.C., have been totally destroyed by fire. Equipment loss includes one 9-ft. double cutting band mill and one 8-ft. band mill. Loss was covered by insurance. Owners will rebuild next spring.

Drummondville, Que.
The match factory of the Canadian Match Company has been destroyed by fire.

Exeter, Ont.
Seating, fixtures, etc., will be required by Mr. W. Leavitt, Exeter, for Picture Theatre, owner having purchased building which will be remodelled.

Fort Erie, Ont.
Barn owned by Otto Redlatz has been destroyed by fire. Loss $3,000, insurance $2,500.

Granby, Que.
Store and residence owned by Mrs. O. Taillefer, have been destroyed by fire, incurring a loss of $6,000. Property was insured and owner will rebuild.

Hull, Que.
The furniture store of Mr. Jos. Paquin, Youville Street, has been destroyed by fire at a loss of $29,000, made up of $25,000 in stock and $4,000 in buildings. Insurance said to be only $9,000.

Listowel, Ont.

A planing mill, stable and coal and wood sheds, the property of Mr. Oliver Ellis Wallace, have been destroyed by fire. Loss is estimated at $2,000. Insurance $1,000.

Levis, Que.

Brick station and baggage rooms, the property of the Intercolonial Railway Company, have been destroyed by fire. Loss is estimated at $60,000. Mr. F. P. Gutelins, Moncton, N.B., is the general manager.

Moose Jaw, Sask.

The International Linseed Oil Company, Cincinnati, Ohio, intends erecting a large flax mill and elevator here. The mill is to be completed by July 1. The elevator will have a capacity of 250,000 bushels.

Montreal, Que.

Tenders will be called shortly by the architect, Mr. Marins Dufresne, Lasalle and Ontario Streets, Maisonneuve, for several trades in connection with the construction of offices and apartments on Mansfield Street for Mr. Oscar Dufresne, 45 St. Elizabeth Street. Building will be four-storey, 40 x 90, brick and Indiana limestone construction. Contracts for stone work and reinforcing have already been let.

A permit to erect a store on Dorchester Street has been issued to Mr. J. B. Lemon, 148 St. Hubert Street.

A permit has been issued to the Brothers of Charity, 341 Demontigny St., for the construction of a printing office estimated to cost $4,828. Mr. Alf. Mercure, 419 Labrecque Street, is the general contractor.

Mr. Sydney Comber, 1215 Green Avenue, Westmount, is receiving tenders on steel in connection with the construction of three-storey, 100 x 25 ft. reinforced concrete, brick and steel stables on Western Avenue at an estimated cost of $20,000. Mr. Armand Malo, 100 St. Jerome Street, is the owner.

Niagara Falls, Ont.

Mr. John Robinson, River Road, is [illegible] heating plant to heat two offices; coil for heating water, also large stove for garage, 75 x 50 ft.

North Vancouver, B.C.

Specifications for second unit of $5,000,000 shipbuilding plant on Lynn Creek [illegible] proval. Construction of unit will be started in about three weeks. Dominion [illegible]

Ottawa, Ont.

[illegible] diere Falls for Mr. J. R. Booth are up one storey. Balance of work will be [illegible] x 45, reinforced concrete construction.

A loss of $1,500 has been sustained by [illegible]

The Canadian Northern Railway Company, care Mr. R. A. Baldwin, 9 Toronto Street, Toronto, are contemplating [illegible] tion.

Tenders are being received by Messrs. James & Ramsay, 70 Fairmont Avenue, general contractors, for plastering, painting, heating, plumbing and electrical work on addition to factory on Slater Street, the property of Mr. W. Nixon, estimated to cost $6,000. Mr. Nixon will be in the market shortly for about $7,000 worth of refrigerating and candy-making machinery.

Lumber building and yard owned by Barrett Bros., Catherine Street, has been destroyed by fire. Loss $6,000.

Plans are drawn for roller sheds here to be frame construction, concrete foundation, shingle roofing. Work has not yet started. Mr. F. C. Askwith is the engineer.

Redcliff, Alta.

The City Council has adopted by-laws authorizing the building of an industrial spur track to cost $2,900, and the erection of a storehouse and the purchase of tools and implements, estimated cost, $2,300. Mr. J. E. Askwith is the city engineer.

South Vancouver, B.C.

The Standard Refining Company, Edmonton, Alberta, have in contemplation the erection of a branch factory at the foot of Main Street for the manufacture of oils and greases. Estimated cost, $4,000.

Toronto, Ont.

Work has started on two of the six stores to be erected on Bloor Street and Indian Road at a cost of $15,000, for Mr. R. T. Smith, 80 Roncesvalles Ave. Work on the other four is to be commenced in the spring. Buildings will be brick construction, stone foundation, felt and gravel roofing. All material will be purchased by the owner.

The City Council having passed a by-law, work will start immediately on the construction of a car barn on Bloor St. W., frame construction, sheet metal roofing. Temporary tracks are now being laid for the line on Bloor West from Dundas Street. Mr. R. C. Harris is Commissioner of Works. Work on the car barn will be done by day labor.

Winnipeg, Man.

The Globe Pump Company, Green Bay, Wisconsin, are negotiating for a site on which to erect a branch pump factory here. Mr. R. T. Byington is the [illegible]

Windsor, Ont.

A factory belonging to the Commercial Truck Company, Goyean Street, has [illegible]

CONTRACTS AWARDED

Barrie, Ont.

The sub-contract for plumbing in con[illegible] on Elizabeth Street for Mr. D. Waisberg, has been let to Mr. J. J. Neelands, Dunlop Street. Contracts for plastering, [illegible] Mill, Bayfield Street, have the general contract.

Hamilton, Ont.

The following contracts have been [illegible] Holton Knitting Company, at an esti[illegible] and masonry, Mr. G. E. Mills, Hamilton; carpentry, Mr. James Calvert, Hamilton; roofing, Mr. John E. Riddle, Hamilton. The contract for mill work has not yet been let. Factory will be two-storey, mill and brick construction. Messrs. Stewart & Witton, Hamilton Prov. and Loan Bldg., are the architects.

Ottawa, Ont.

The contract for alterations to store and residence estimated to cost $2,500 for Mr. W. J. Kidd, Egan Building, has been let to Mr. R. F. Murphy, 152½ Bank Street. Construction will be solid brick, felt and gravel roofing.

The contract for supply and erection complete in the Isolation Hospital of belted elevator machinery, of 2,000 lbs. capacity and a speed of 50 ft. per minute, has been awarded to the Otis-Fensom Elevator Company by the City Council.

Windsor, Ont.

The general contract for erection of two fire halls, 1½ storeys, 46 x 30, stucco construction, for the City Council, has been awarded to Mr. Art. Selby, 42 Elliott Street. Estimated cost of halls $3,500 each. G. Jacques & Company, Boug Bldg., are the architects.

Residences

Charlottetown, P.E.I.

Plans are drawn and work will be started next spring on the construction of $4,000 residence on Fitzroy Street, for Mr. Donald Nicholson. Building will be two-storey, 24 x 36, frame construction, concrete foundation. Messrs. McLean & Barrett, Charlottetown, are the architects and general contractors.

Hamilton, Ont.

Tenders on separate trades will be received by Mr. J. Knight, 227 Hunter Street E., for $4,000 residence, 2 storeys, 26 x 34, brick construction, on Prospect Street. Mr. C. B. Patterson, 167½ King Street E., Hamilton, is the architect.

Montreal, Que.

A permit for the erection of five flats, 3 storeys, 25 x 67, on St. Denis, has been issued to Mr. Wm. Ranger, 1462 Messier Street. Mr. Treffle Bellhumeur, 1420 Messier Street, has the general contract. Estimated cost $5,500.

A permit has been issued to Mr. Pierce Bouliane, 2360 Boyer Street, for the erection of a flat.

A permit to build ten flats at an estimated cost of $7,000, 3-storey, 50 x 40 has been taken out by Mr. E. L. Villeneuve, 2599 St. Lawrence. The general contract has been awarded to Mr. Jos [illegible] mount

[illegible] Avenue, at an estimated cost of $9,500. Mr. E. Leblanc, 2213 Waverley Street, [illegible]

[illegible] Street, to build three residences here, [illegible]

Ottawa, Ont.

[illegible] Hines, Holland Street, Ottawa W., has

(Continued on page 64)

Tenders and For Sale Department

FOR SALE

The No. 6 Kennedy Gyratory Stone Crusher [illegible] One extra eccentric [illegible] Elevator [illegible] belt tightener, etc. One revolving screen, five by twelve [illegible] pulleys, etc. One main drive belt. All in good condition. Can be seen at [illegible] Price reasonable. For price and terms address Box 111, Contract Record, Toronto. 48-49

To Contractors

Sealed tenders addressed to either of the undersigned will be received until noon on **Tuesday the 8th day of December** for building a steel riveted truss bridge over the River Thames between the Counties of Elgin and Middlesex (known as the Tait Bridge) length of span C to C, 220 feet and also for the steel beams and railing required for 255 feet of approach. Also for the concrete work consisting of abutments, piers and pedestals.

A certified cheque payable to the Treasurer of one of the Counties for 5 per cent. of the amount of tender must accompany tender. Plans and specifications may be seen at the office of the undersigned. Lowest or any tender not necessarily accepted.

JAS. A. BELL, C.E.,
Engineer for Elgin, St. Thomas.

CHAS. TALBOT, C.E.,
46-48 Engineer for Middlesex, London.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Freight Elevator, Ottawa City Post Office, Ottawa, Ont.," will be received at this office until **4 p.m. on Wednesday, December 9, 1914**, for the installation of one (1) standard freight elevator in the Ottawa City Post Office, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department, at the offices of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. R. L. Deschamps, Superintendent of Public Buildings, [illegible]

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be [illegible]

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 18, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the [illegible] 70253 47-48

Tenders for Construction of Sewers

Sealed tenders plainly marked as to contents will be received by the undersigned up to **noon** of **Monday, December 7, 1914**, for the construction of Sewers on Pape and Randolph Avenues, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto. The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, November 25, 1914. 48

Tenders for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 8th, 1914**, for the supply of:—

1. Brass and Bronze Castings.
2. Brass Work for House Services.
3. Cast Iron Pipe.
4. Hydrants.
5. Lead Pipe.
6. Special Castings.
7. Stop Valves.

Specifications and Tender Form for any of the foregoing may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Conditions relating to tendering, as prescribed by City By-law, must be strictly complied with or tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto.
November 25th, 1914. 48

Residences

(Continued from page 63)

been destroyed and barn partially destroyed by fire. Loss $4,500.

Contracts for plastering and painting are to be re-awarded shortly for $21,000 Apartments on Nelson Street for Mr. Louis Green, 283 Bank Street. Mr. W. G. Davis, 5 Spruce Street, is the architect.

Residence on Catherine Street, owned by Mr. Louis Charron, 375 Catherine Street, has been destroyed by fire involving a loss of $2,600, partially insured.

Tenders are at present being received by Mr. Stanley Smith, Spadina Avenue (owner) for plastering, painting, heating, and electrical work on $4,500 residence, brick construction. Mr. W. G. Davis, 5 Spruce Street, is the architect.

Tenders will be invited shortly for plastering, painting, heating, plumbing and electrical work on $5,000 double residence, concrete block construction, to be erected on Bellwood for Mr. B. A. Grison, 100 Fentiman Avenue, who will supply concrete blocks.

Prices are still open for plastering, painting, heating, plumbing and electrical work and will be received by the owner, Mr. D. Fraser, O'Connor Street, in connection with two brick veneer residences to be erected on Nelson Street at an estimated cost of $7,000. Mr. Robert W. Watson, 186 Hawthorne Street, has the general contract.

St. John, N.B.

Mr. John Neilson, St. John E., will rebuild two residences which were destroyed by fire recently. Estimated cost $6,000.

Sarnia, Ont.

Plans are in progress with Mr. Eric

Tenders for 20 Million Gallon Centrifugal Pumps

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, December 22nd, 1914.**

For Supply and Installation of One or More 20 Million Gallon Centrifugal Pumps

Specifications and Tender Form for any of the foregoing may be obtained upon application at the Accounting and Purchasing Section of the Department of Works, Room 12, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Conditions relating to tendering, as prescribed by city by-law, must be strictly complied with or tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto.
November 26th, 1914. 48

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, December 11th, 1914

for

Enlargement of Leslie Street School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender, applying to said tender only, or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer, at his office in the Ctiy Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

J. W. JACKSON,
Chairman of Committee.

[illegible]
48 Secretary-Treasurer.

Tenders Wanted

Board of Education

New Central Technical School

[illegible]

Friday Noon, December 11th, 1914

for

Power Plant Equipment

[illegible]

Steam Engines, Generators, Switch Board, Steam Piping and Electrical Connections

[illegible] cheque for five per cent. of the amount of ten[illegible]

J. A. ELLIS,
[illegible]

[illegible]
48 [illegible]

Coultis, Thedford, Ont., owner and architect, for the construction of a frame and white brick residence.

Toronto, Ont.
Mr. A. McFarren, 1558 Yonge Street, is open to receive tenders on plastering, galvanized iron, tiling, electric wiring, plumbing and heating in connection with a $5,000 residence, 2½-storey, 35 x 42, brick construction.

Foundation only will be completed at present on $10,000 duplex residence on Keele and Geoffrey Streets for Mr. A. G. Love, 561 Shaw Street. Walls are to be started in the spring. Residence will be two storeys and basement, 35 x 50, brick construction.

Sketches are in preparation by Mr. S. A. Waggett, 125 Isabella Street (architect), for $300,000 rooming house which will be steel frame, stone and brick construction. Building will be centrally located.

Plans are drawn for detached residence estimated to cost $4,500, for Mr. J. F. Alexander, 8 Temple Avenue. Owner may let plastering, painting, heating, plumbing and electrical work. Building will be 2½ storeys, 24 x 42, brick construction and foundation.

Westboro, Ont.
Plans have been drawn by Mr. W. E. Noffke, 45 Rideau Street, Ottawa, for $3,000 alterations to residence of Mr. Charles Ogilvy, 293 Stewart Street, Ottawa. Construction will be stucco and brick, concrete foundation.

CONTRACTS AWARDED

Hamilton, Ont.
Sub-contracts have been let as follows in connection with new apartment house on Bay Street, 5 storeys, 25 x 65 ft., reinforced concrete and fireproof construction, estimated to cost $100,000 for syndicate: Carpentry, Mr. John Poag; heating, Mr. Adam Clark; Stewart & Witton, 7 Hughson Street South are the architects.

Toronto, Ont.
Contracts have been awarded as follows for residence on Wilcox Street for Mr. H. Rotenberg, 120 University Avenue, at an estimated outlay of $12,000:—Masonry, Smallwood Bros.; sheet metal, Feather & Roadhouse; carpentry, Mr. A. W. Homan; wiring, Canadian Electric Fixture & Contracting Company; painting, Bavington Bros.; plaster[illegible] plumbing and heating, Sheppard & Abbott; tile floors, etc., Canada Glass Mantels & Tile Company. Building will be [illegible] construction and foundation. Mr. I. Fendman, 44 Adelaide Street W., is the architect.

Power Plants, Electricity and Telephones

Montreal, Que.
[illegible] are being received by Mr. E. B. Evans, 357 St. Catherine Street W., general contractor, in connection with the erection of a [illegible] boiler house on St. Antoine Street for [illegible] Company. [illegible] Messrs. MacVicar & Heriot, 164 Union Avenue, are the architects.

Newmarket, Ont.
The ratepayers here will vote on a by-law January 4 to authorize the raising of $15,000 to provide for the erection of a power station and the installation of hydro-electric power. Mr. J. E. Hughes is the town clerk.

St. Marys, Ont.
The Town Council has in contemplation an extension of electric lighting 1½ miles along Widder Street. In connection with the project a quantity of poles, wiring arms, etc., will be required. Mr. Thomas M. Clark is town clerk and Mr. Miller is superintendent of the Water, Light and Heat Board.

CONTRACTS AWARDED

Transcona, Man. (Winnipeg)
The general contract for erection of pumping station here at an estimated cost of $7,700, for the Municipality of Transcona, has been awarded to Geo. H. Archibald & Company, Limited, Winnipeg.

Miscellaneous

Thamesville, Ont.
The Town Council contemplates installing a fire alarm system here. Mr. W. J. Cryderman is the town clerk.

Hamilton, Ont.
The Harbour Commissioners are contemplating the enlarging of the Desjardines Canal to a width of 300 ft. and a depth of 25 ft. The scheme also includes the reclamation of Marsh lands and the building of roadways. Mr. H. E. Waterman, 67 James Street S., is secretary of Harbor Commissioners.

New Companies

H. Chagnon & Compagnie Limitee has been incorporated with a capital stock of $99,000, as general lumber merchants, including sawing, planing and the manufacture and sale of doors, sashes, windows, etc. The company's head office is at Montreal and the provisionsl directors include Horace Chagnon, manufacturer, and Jules Ulderic Matheu, Montreal.

Soper & McDonald, Limited, have been incorporated with head office in Ottawa, Ont., and capital stock of $50,000, to carry on business as a general construction company and general contractors. The provisional directors include Albert Newson Soper and Norman [illegible] of Ottawa.

Compagnie, Contant, Monette & Pion, Limited, have been incorporated to deal in hardware and building materials and to carry on business as wholesale and retail dealers in chemicals. The head office will be at Montreal, Que., and the capital stock of the company is $40,000. The incorporators of the company include Arthur Contant, Lectance Chas. Monette and Joseph Wilfrid Pion, all of Montreal.

The Sandwich Bay Pulp & Lumber Company was incorporated recently with a capital stock of $2,000,000 and chief place of business at Montreal. The incorporators are [illegible] and Oscar Beauchamp, all of Montreal.

[illegible] Limited, have been incorporated with a capital stock of [illegible] and head office at Montreal, as general contractors and builders, [illegible] also manufacturers and dealers in all kinds of building material and supplies; [illegible] as a going concern and [illegible] on business of the Mosaic and Tile Company. Messrs. Ernest C. [illegible], S. Homer Calkins, salesman, and David J. Wilson, all of Montreal, are amongst the incorporators.

Business Notes

Brampton, Ont.

In connection with the erection of two bungalows on Elizabeth Street, for Mr. C. Greenwood, care of Victoria Hotel, Brampton, owner will purchase furnace, grates, cement and bathroom fixtures. Mr. A. Butler, care of Victoria Hotel, Brampton, is the architect.

Montreal, Que.

The contract for plastering four residences for Mr. Godfrey Boileau, 324 Lafontaine Park, will be sublet by the owner. Buildings are three-storey, 100 x 45. Estimated cost $10,000.

Owen Sound, Ont.

The Oliver Rogers Stone Company, 1170 First Avenue West, are in the market for one gyratory rock crusher, No. 6 or [illegible]

Trade Inquiries

The following inquiries relating to Canadian trade have been received. The names of the firms making these inquiries and their addresses, can be obtained upon application to "The Inquiries Branch, Department of Trade and Commerce, Ottawa," or the Secretaries of the various Boards of Trade throughout the Dominion:

1165. **Iron and steel.**—Commission agent wishes to negotiate with Canadian manufacturer with a view to secure buying and selling agency in Argentine Republic of pig iron, iron bars, iron and steel wire, and steel rails.

1166. **Dynamos, electric motors, electric supplies.**—Commission agent desires buying and selling agency in Argentine Republic for dynamos, electric motors and electric supplies of Canadian manufacturers.

1167. **Railway ties.**—A London firm which has large inquiries for cedar and other railway ties, sawn square, invites quotations c.i.f. Liverpool, and from Canadian manufacturers.

1175. **Window glass.**—A London firm reports a large demand for window glass, and asks for names of Canadian manufacturers.

1177. **Machinery.**—A London firm of machinery exporters wishes to get into touch with Canadian importers.

1196. **Asbestos.**—A large Swiss firm in Kobe, Japan, wishes to get into communication with producers and exporters of asbestos fibre.

Late News Items

Hamilton, Ont.

A joint committee of civic, county and board of trade representatives are considering two plans prepared by the Hamilton bridge works for a bridge in connection with the Toronto-Hamilton highway, west of the high-level bridge at Carrol's Point. The committee have also decided to have plans for a concrete structure prepared by the Canada Cement Company.

Plans have been prepared and tenders will be called shortly for $10,000 residence on Mountain Top for Mr. W. E. Blandford, c/o Brown & Boggs Company, 37 Victoria Avenue North. Residence will be brick construction, shingle roofing. Messrs. Watt & Blackwell, 125 Lister Chambers, are the architects.

Lambeth, Ont.

A by-law has been passed to authorize the raising of $4,000 for a hydro-electric power supply to the village.

Lucan, Ont.

Tenders will be called in a few days for alterations to church estimated to cost $2,500 for Lucan Methodist Congregation. Plans are at present in the hands of the building committee for approval. Building will be white brick construction. Mr. J. V. Munro, Bank of Toronto Chambers, London, is the arachitect. Mr. Gibson is a member of the building committee.

London, Ont.

Electric fittings for $15,000 residence on Dufferin Avenue, will be purchased by the owner, Mr. D. H. Howden, 206 York Street. The building is two-storeys, 31 x 37, steel and brick construction. Messrs. Watt & Blackwell, Bank of Toronto Chambers, are the architects.

Ottawa, Ont.

Tenders close January 4, 1915, with Commissioners of National Transcontinental Railway (Mr. P. E. Ryan, Ottawa, Secretary), for contract to supply a number of travelling cranes to be erected in connection with locomotive and car shop plants, at Quebec. Plans, etc., are at office of Mr. W. J. Press, mechanical engineer, Ottawa.

Quebec, Que.

The Quebec Preserving factory, 33 Smith Street, was burned down recently, involving a loss estimated at $60,000. The factory will be rebuilt and a quantity of machinery will be required.

St. Cesaire, Que.

A cigar factory, the property of Messrs. Ares & Fleury, St. Cesaire, which was destroyed by fire recently at a loss of $30,000, will be rebuilt shortly.

St. Lambert, Que. (Montreal)

Plans are drawn and Greenfield Park School Commissioners will call for tenders in a few days for the erection of fire escapes for school building.

Smith's Falls, Ont.

The Smith's Falls Brass & Aluminium Foundry Company, Limited, has been incorporated with a capital of $60,000 to manufacture brass, bronze and aluminium castings. The head office will be at Smith's Falls, Ont. Messrs. McDonald & Henniker, Chamber Street, Smith's Falls, are interested.

Toronto, Ont.

The United Rifle Clubs, Limited, was incorporated recently with head office at Toronto to operate rifle ranges, shooting galleries, etc. The company has a capital of $40,000 and those interested include Mr. T. A. Silverthorn and Mr. F. J. Foley, Kent Building.

The Gilmour Lime & Gravel Company, Limited, c/o Robins, Limited, Victoria Street, has been incorporated to conduct general quarry business, etc. The chief place of business is Toronto and the company has a capital of $75,000.

The Creosoted Block Paving Company, Limited, is a new incorporation with $100,000 capital and head office at Toronto. The company's operations will include general paving and roadway work. Messrs. C. H. Lattimore, Bell Telephone Building, and J. L. Boyd, 84 Victoria Street, are interested.

Prices are wanted by the school board on sixty single desks and seats, also blackboards, to be delivered before January 1. Mr. J. L. Clarke, 13 Brookside Avenue, is secretary-treasurer.

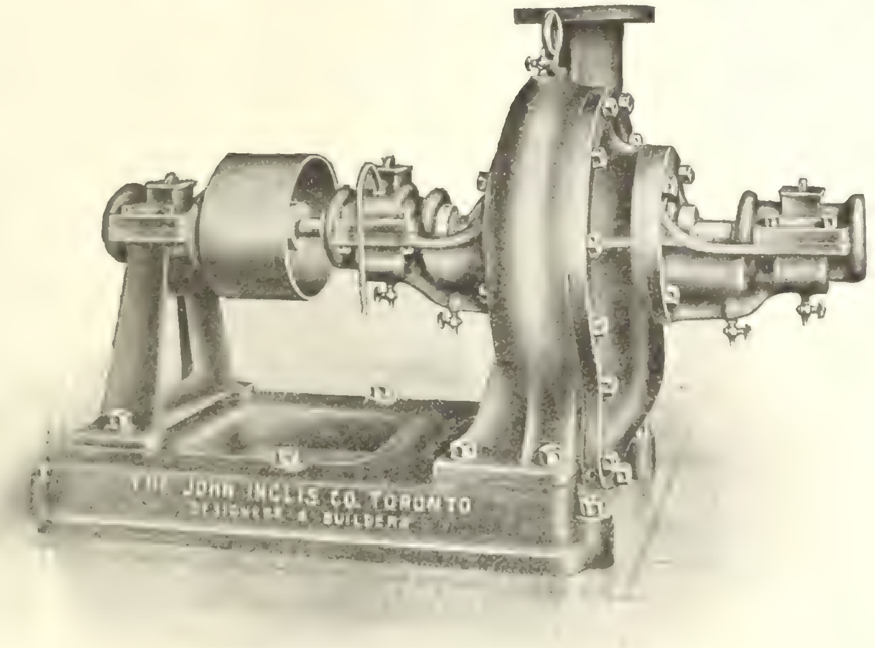
Weston, Ont. (Toronto)

The council has decided to submit a by-law to the ratepayers authorizing the borrowing of $6,000 to pay the balance due on land, pump house, sedimentary basin and reservoir in connection with the town's water-works system. The vote will be taken on Thursday, December 31. Mr. J. H. Taylor is the clerk.

Two 10-yd. dippers of manganese steel, weighing approximately 37,600 lbs. each, were purchased recently by the United States Government, to be used on the dipper dredges Paraiso and Gamboa, which are operating at the Panama Canal. These are the largest manganese dippers made to date and are of the so-called Missabe type, patented and manufactured by the Edgar Allen American Manganese Steel Company for the Bucyrus Company. Manganese steel is used throughout, except for bolts, nuts and rivets. The over-all dimensions are 10.5 x 9 x 9 ft. The lips are 3¼ in. thick; the fronts are 3¼ in. thick underneath the teeth, 1½ in. between the teeth and 3¼ in. at the bottom band; and the backs are 1¼ in. thick at the sides and 3¼ in. at the bottom bands. The body consists of the front and back castings. The lap joints at the sides make the dipper rigid and relieve the rivets from strain. The bail brackets are attached to the front casting at an angle conforming to the line of the pull on the bail, which throws the strain of the pull directly on the front casting. Shoulders or offsets to relieve the strain on rivets are provided throughout.

Domes of plasterboard for use as fillers for concrete joist floors are the latest addition to the list of devices to lighten floor construction and simplify form work. They are designed to support the load of wet concrete load only. The domes are made of Sackett board, three layers of plaster reinforced by four layers of paper. The domes are dipped in a weatherproofing compound. This is to protect them while in storage and on the forms before pouring the concrete over them. This process is said to be unnecessary as far as moisture from the concrete is concerned. The boards are ½ in. thick and as they come from the rolls wet are laid in pans to give them the dome shape, 3 ft. long, 6 to 12 in. deep and 24 to 30 in. wide between the joist centers. The domes weigh 7 lb. per square foot in the 10-in. depth, about one-fifth that of clay tile. Before placing the domes on the market the manufacturers the United States Gypsum Co., tried them out on four floors at their Chicago mill, one floor at the Oakfield (N. Y.) mill and one at the Fort Dodge (Iowa) mill.

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—[illegible] lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, [illegible] $1.95.

Lime—[illegible] white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $55 per M. Lots over 100,000, $50.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 66c. per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

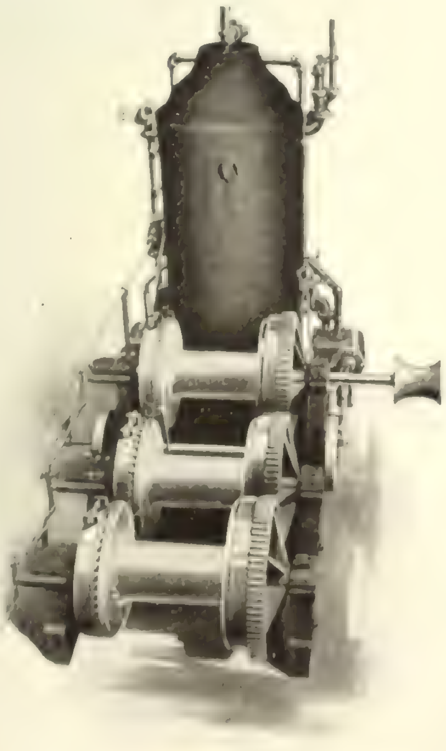
BAR STEEL

Warehouse Stocks:
SYDNEY, N. S.
MONTREAL, QUE.
TORONTO, ONT.
FT. WILLIAM, ONT.

Sales Offices:
SYDNEY, N. S.
MONTREAL
112 St. James St.
TORONTO
18 Wellington St., E.

Mills and General Offices:
SYDNEY, N. S.

WIRE NAILS and other **WIRE PRODUCTS**



Stanard Three Drum Hoisting Engine

Canadian Contractors!

Canada Needs Your Business

BEATTY

Hoisting—Material Handling—Excavating Equipment

Has always been Made in Canada

Hoisting Engines—Clamshell Buckets—Steel Derricks—Timber Derrick Fittings—Centrifugal Pumps

Standard Sizes Ready to Ship

REPAIRS

We are in fine shape this Winter to take care of your repair work. Our large stock of patterns, our years of experience, our engineering and manufacturing facilities enable us to handle repair jobs on Dredges and other equipment at minimum cost to you.

Careful attention given all inquiries on repairs and special equipment.

CATALOGUE SENT ON REQUEST

M. Beatty & Sons, Limited

Welland Established 1862 Canada

AGENTS:
H. E. PLANT [illegible] St. James Street, Montreal
E. HAMILTON & Co. Vancouver, B.C.
M. BEATTY & SONS, LTD. Goodyear Bldg., Toronto
H. W. PETRIE LIMITED Toronto, Ont.
E. LEONARD & SONS St. John, N.B.
A. R. WILLIAMS MACHINERY CO. Winnipeg

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving **would have enriched your treasury approximately a quarter of a million.**"

The "Contract Record" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

347 Adelaide Street West, Toronto

Canada Wire & Cable Co., Limited

Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes.

Electric Railway Trolley Wire and Feeder Cable.

Sales Offices and Branch Warehouses:
401 Lake of the Woods Building, MONTREAL.
150 Princess Street, WINNIPEG.
Macdonald Marpole Co., Ltd., 427 Seymour St., VANCOUVER.

Prompt shipments from Factory or nearest warehouse.

ROCALITE

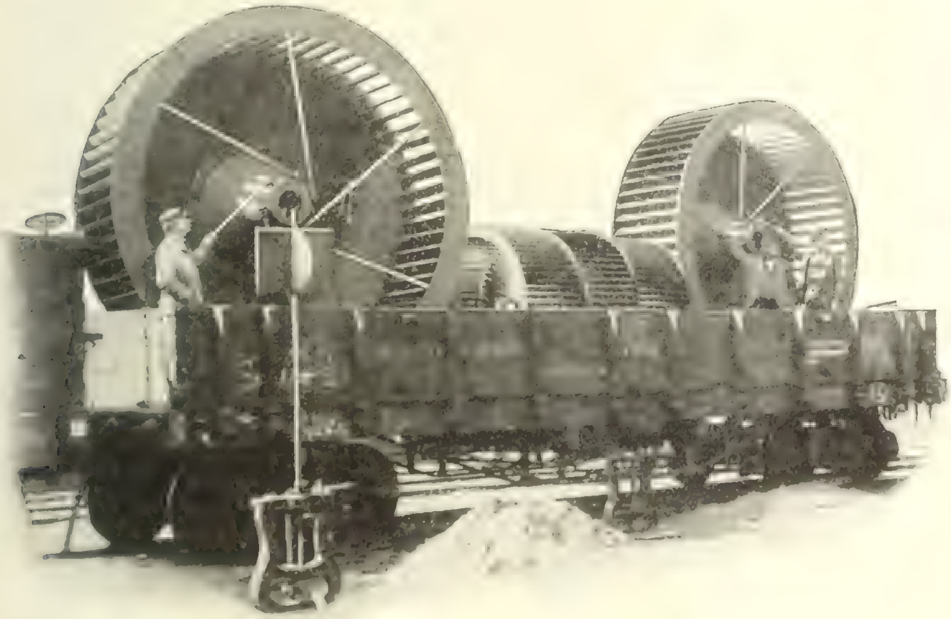
The Ready Mixed

Hard Wall Plaster

Manufactured by

Alex. Bremner

Limited
100 Bleury Street - - MONTREAL



The Genuine

"Sirocco"

TRADE MARK.

Patented Multi-Blade Fans and Blowers

The British Navy has indorsed Sirocco Fans to the extent of installing them in their famous fighters to the exclusion of all other types.

Sirocco Patented Fans are used to Heat, Ventilate and Cool Buildings—for Mechanical Draft and for Blowing and Exhausting.

A Bulletin illustrating and describing Sirocco Fans will be mailed to you at your request.

Sales Engineers:
CLARK L. MORSE
301 McGill Bldg
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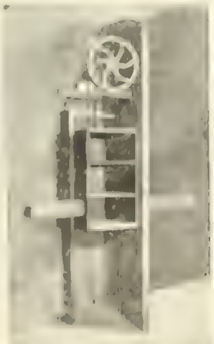
E. G. POWERS
13 Victoria St.,
Toronto

CANADIAN Sirocco COMPANY
Limited
WINDSOR, ONTARIO.

Sales Engineers
W. P. EDDY
301 Tribune Bldg.,
Winnipeg

S. S. CLARKE
605 2nd St.,
Calgary



No. 1 HAND BRAKE DUMBWAITER
40 to 100 lbs. capacity.

CHELSEA

EXEMPLAR OF QUALITY

DUMB-WAITERS

[illegible]

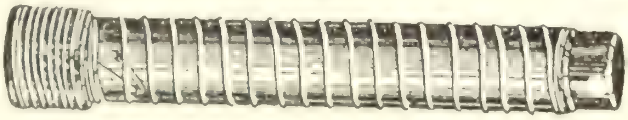
Write our agents for prices.

Chelsea Elevator Co.

NEW YORK

Agents

Hardware Co. of Toronto,
Limited
26 Adelaide St. W.



Continuous and Machine Banded Wood Stave

WATER PIPE

Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe and better.

Pacific Coast Pipe Co., Limited

P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
Write for Catalogue
Full Particulars and Estimates Furnished

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68

SEWER PIPE

Sewer Pipe Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 13c. per ft.; 6-in. 25c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in., 40c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in., $1.50 ft.; 24-in., $2.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 82c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 80c. per gal.; red lead, dry, $8.00 to $9.50 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

Goold, Shapley & Muir Co.
Limited
Brantford Winnipeg Regina Calgary

Towers and Tanks for all purposes.

Concrete Mixers

Gas and Gasoline Engines

Hoists

Windmills

Water supply outfits of every description.

CORRESPONDENCE SOLICITED

"Metallic" Building Materials

Do your part—keep your money "at home"

Now of all times the suggestion of using only Canadian-made building materials should have double force. Keep the "Metallic" catalogues beside you and correspond with us—you'll find we meet your every need promptly and economically with goods that are CANADIAN OR BRITISH MADE THROUGH AND THROUGH.

The "Metallic" line includes "Eastlake" Steel Shingles; "Redcliffe" Corrugated Iron; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fire-proof Doors and Windows; Well Curbing; Culverts; Conductor pipe and Eave-troughs.

N. B. No 'Keystone" or other foreign-made sheets used.

Metallic Roofing Co., Ltd.
Manufacturers—Toronto & Winnipeg

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario

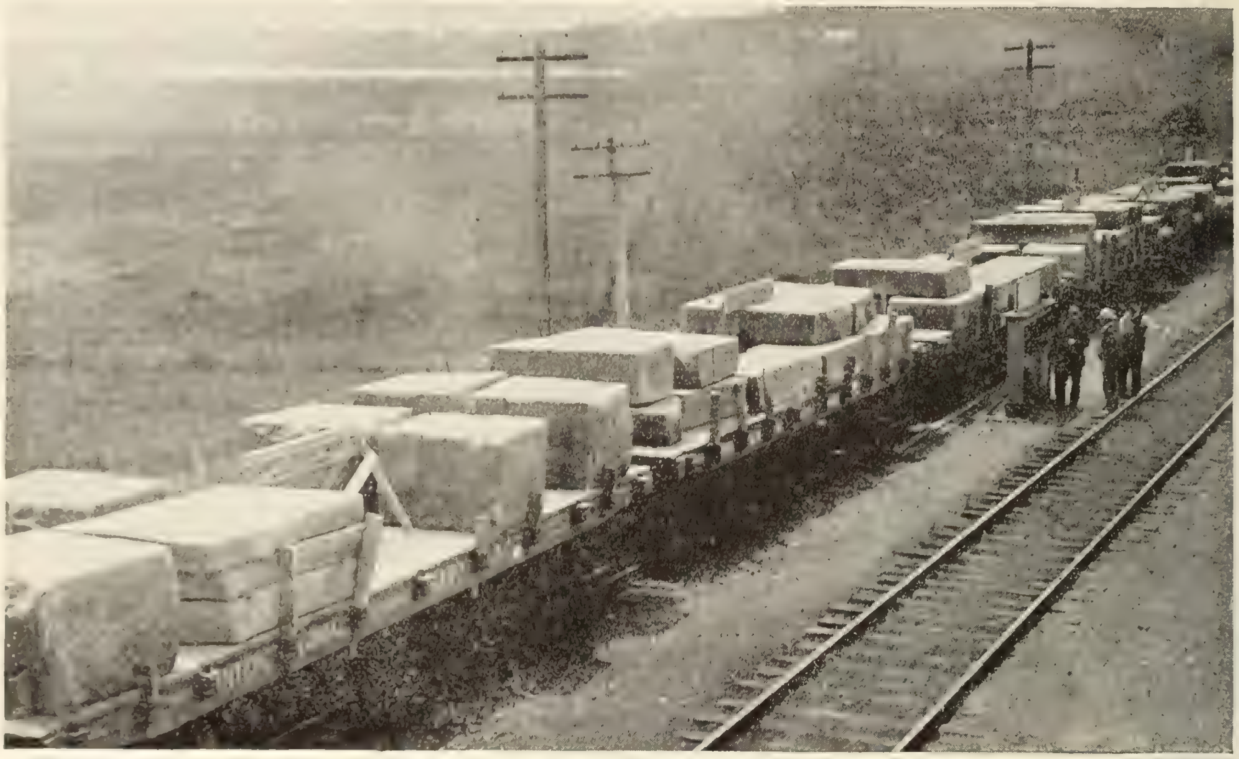
Electric-Welded Chain

Two New Sizes

Size in inches	5/8	3/4
Links per foot	6	5½
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

Made in Canada — 25 Stronger — Sold by Jobbers

McKinnon Chain Company
St. Catharines, Ont.



Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, **Sackville, N. B.**

WRITE US FOR QUOTATIONS

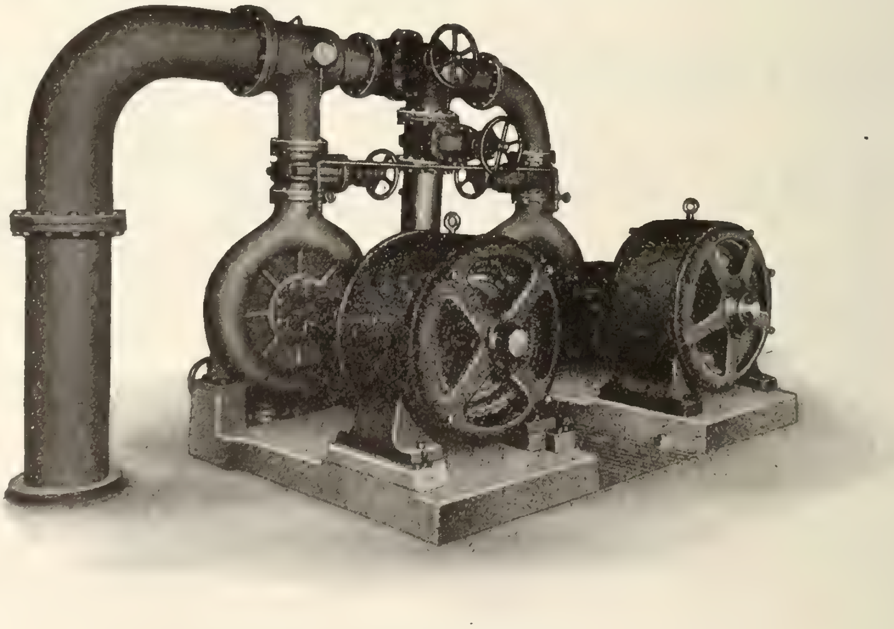
Turbine Pumps

Electric and Steam

Water Works
Factory and
Fire Services

Humphrey Gas
Pumps

Any capacity or pressure

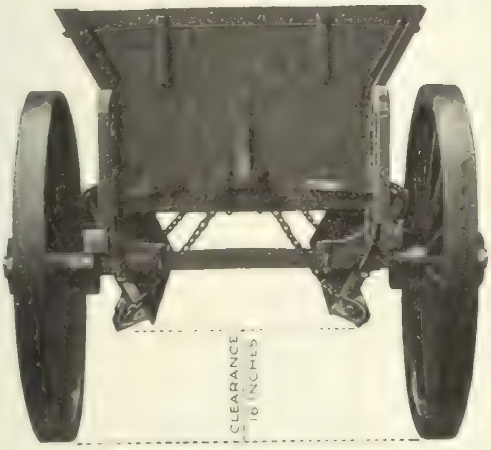


Lachine Water Works
Three million gallons, eighty pounds domestic, 160 lbs. fire.

**THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO., LIMITED**

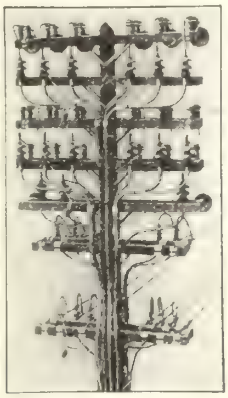
Works: Seigneurs & William Sts., MONTREAL.
Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

The Last Ten Dollars



in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.



The Best Engineering Practice

in the installation of lead-covered cables of all kinds requires that the same care be given to protecting the insulation against moisture, etc., at the ends as at the joints in the manholes.

STANDARD
D. O. A. and D. S. Cable Terminals

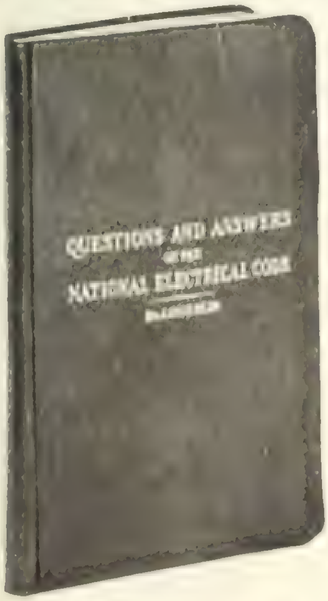
provide this protection and their many exclusive and patented features have been suggested by our over 30 years' experience in the manufacture and installation of lead-covered cables of all kinds.

Bulletins Nos. 700 and 710 give valuable engineering data about terminal construction and installation.

Write our nearest office for copies.

Standard Underground Cable Co. of Canada, Limited
General Offices and Works, Hamilton, Ont.
Montreal, Que. Winnipeg, Man. Seattle, Wash.
Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories of all kinds.

You Can Interpret the Code Instantly with McLoughlin's



Questions and Answers
on the
National Electrical Code

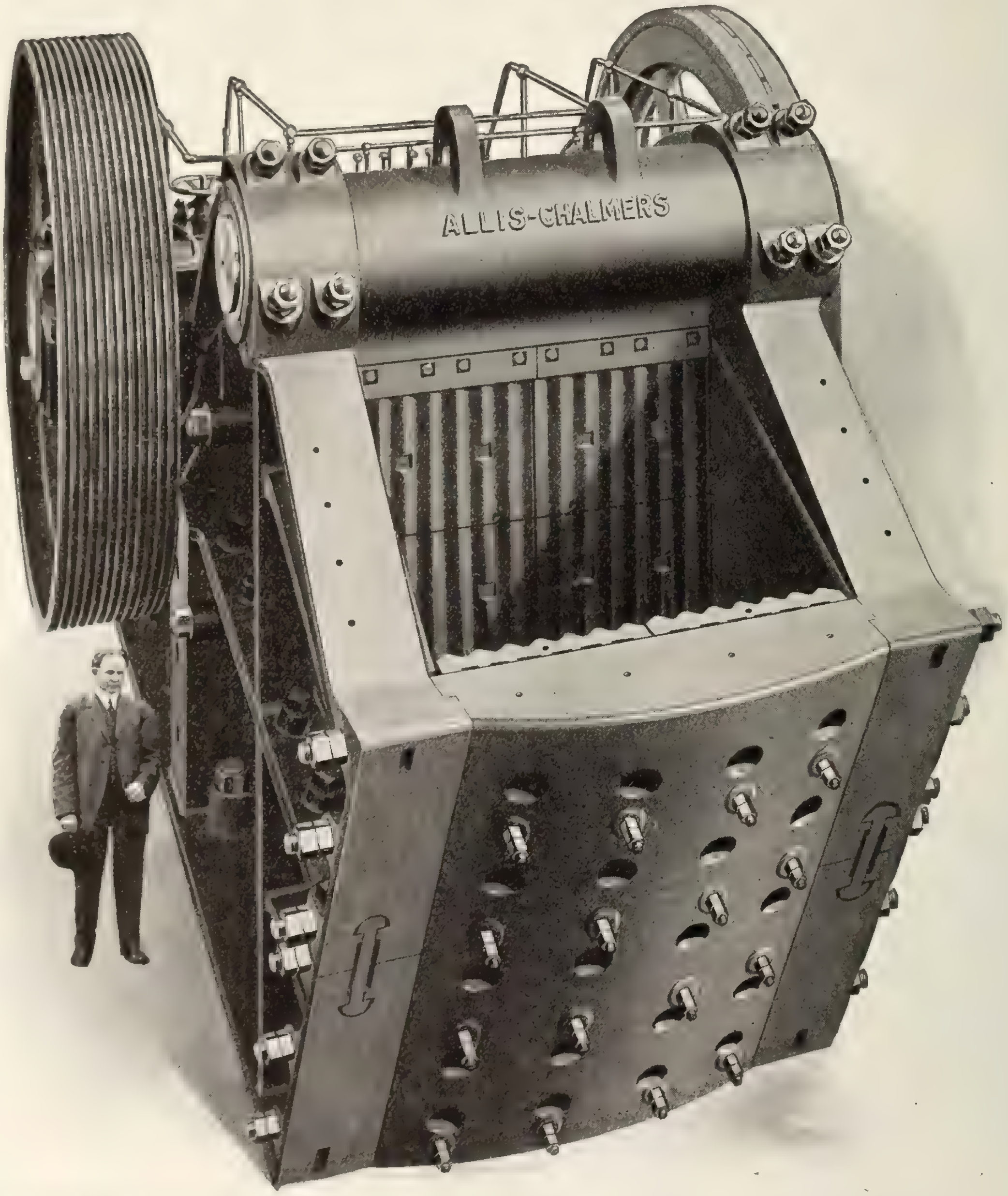
It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.
The latest rules for Resuscitation are included

232 pages, pocket size, flexible binding $1.00 net, prepaid.

For Sale by

Contract Record, - 347 Adelaide Street West, Toronto

Rock Crushers of All Capacities

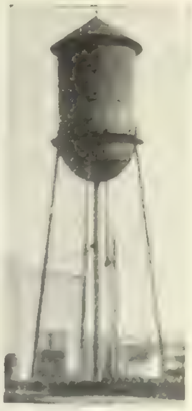


FRONT VIEW OF JAW CRUSHER—Recently sold to a stone company.

Overall Dimensions of this Crusher—length 29 ft. 9¾ in., breadth 16 ft. 5 13/16 in., height 17 ft. 3 in. Approximate weight 510,000 lbs. Receiving opening 66 in by 84 in. Product about 300 tons per hour with 4 7/8 in. opening between jaws, increased 20 per cent. by opening machine to 6 in. Horse power 200 to 250.

CANADIAN ALLIS - CHALMERS, LIMITED

Head Office: TORONTO. District Sales Offices: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VANCOUVER, VICTORIA, PRINCE RUPERT



Built for C.P.R. Montreal

Canadian Plant

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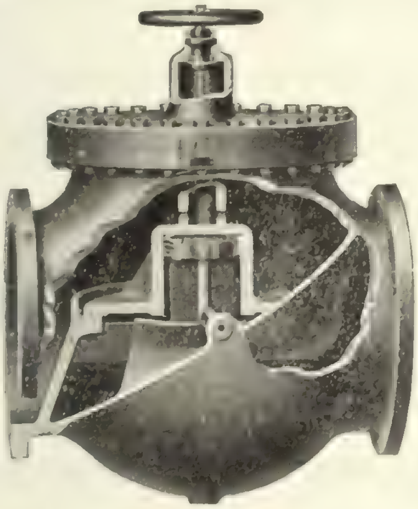

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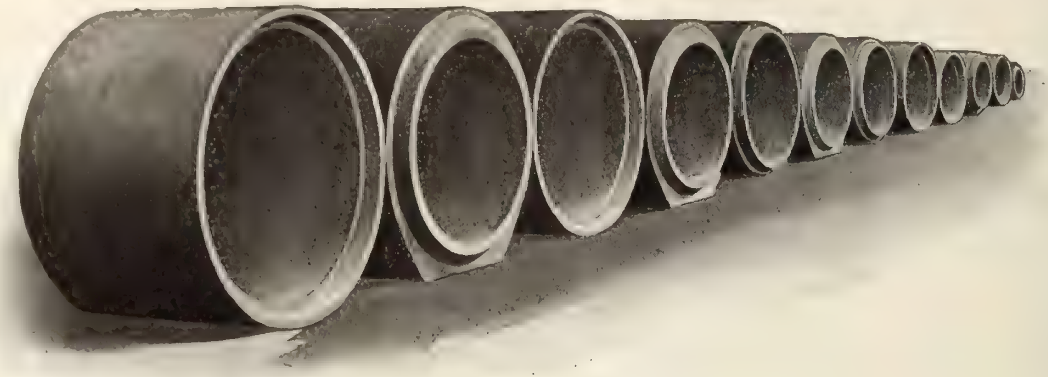

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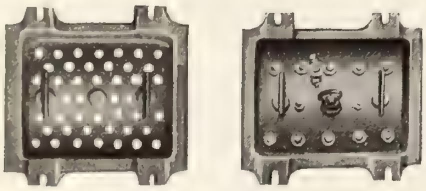

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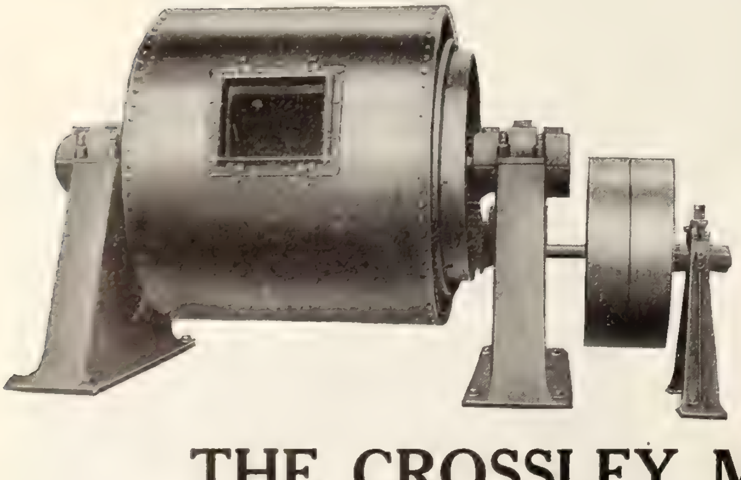

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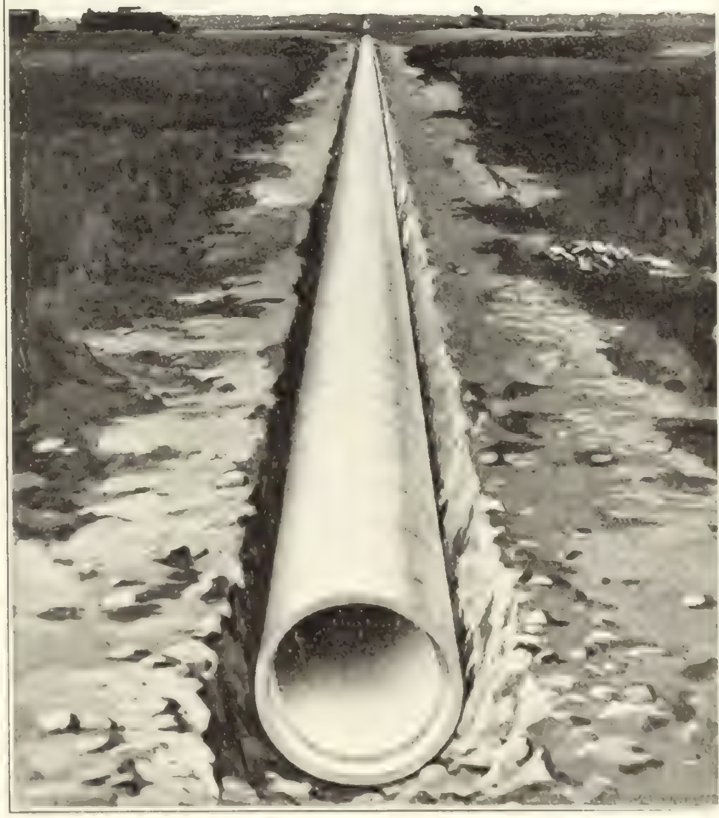

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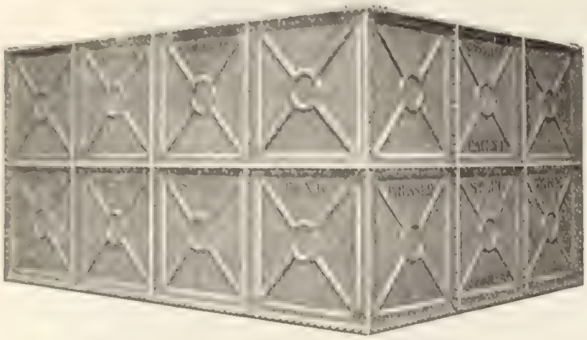

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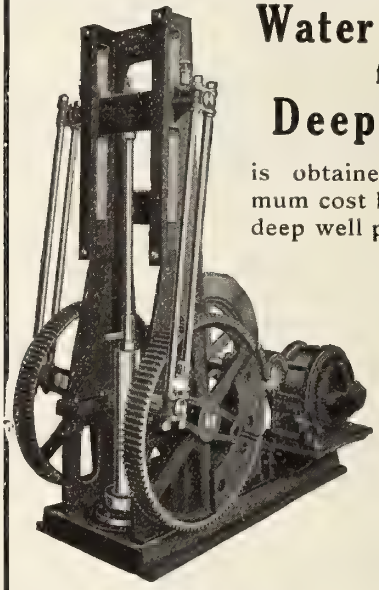

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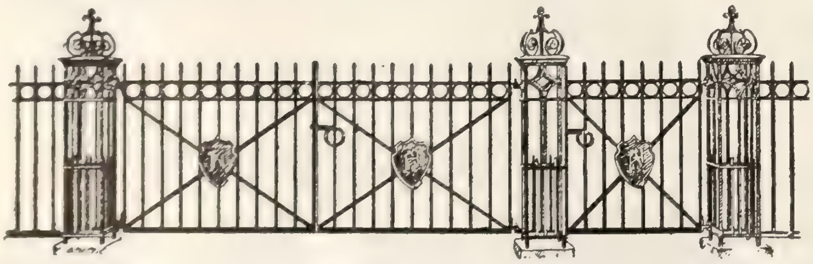

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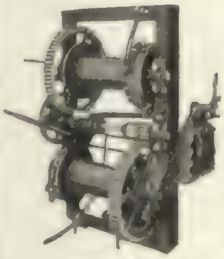
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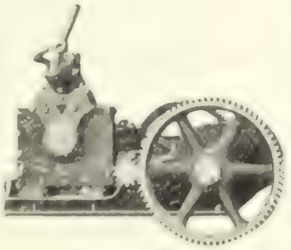
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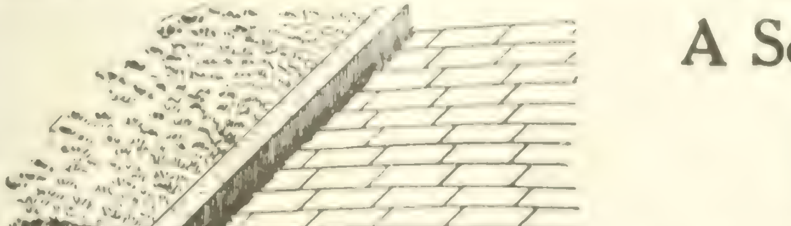

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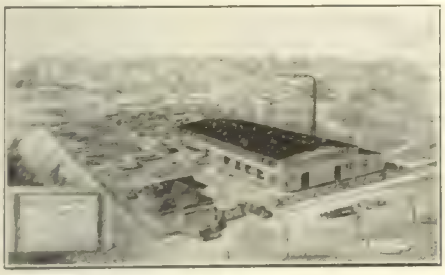

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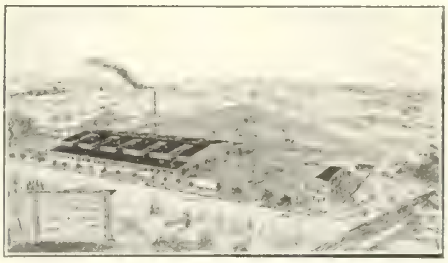

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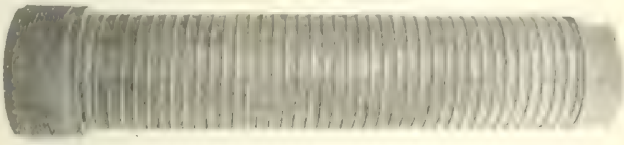

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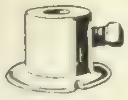


Fig. 1

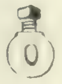


Fig. 2

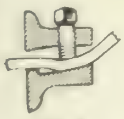


Fig. 3

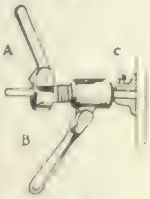


Fig. 4

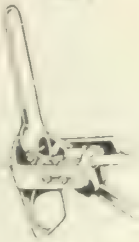
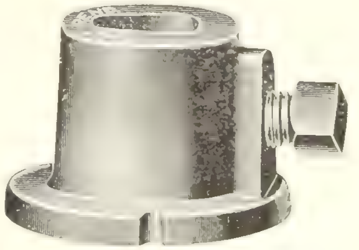


Fig. 5

Use UNIVERSAL CLAMPS
to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

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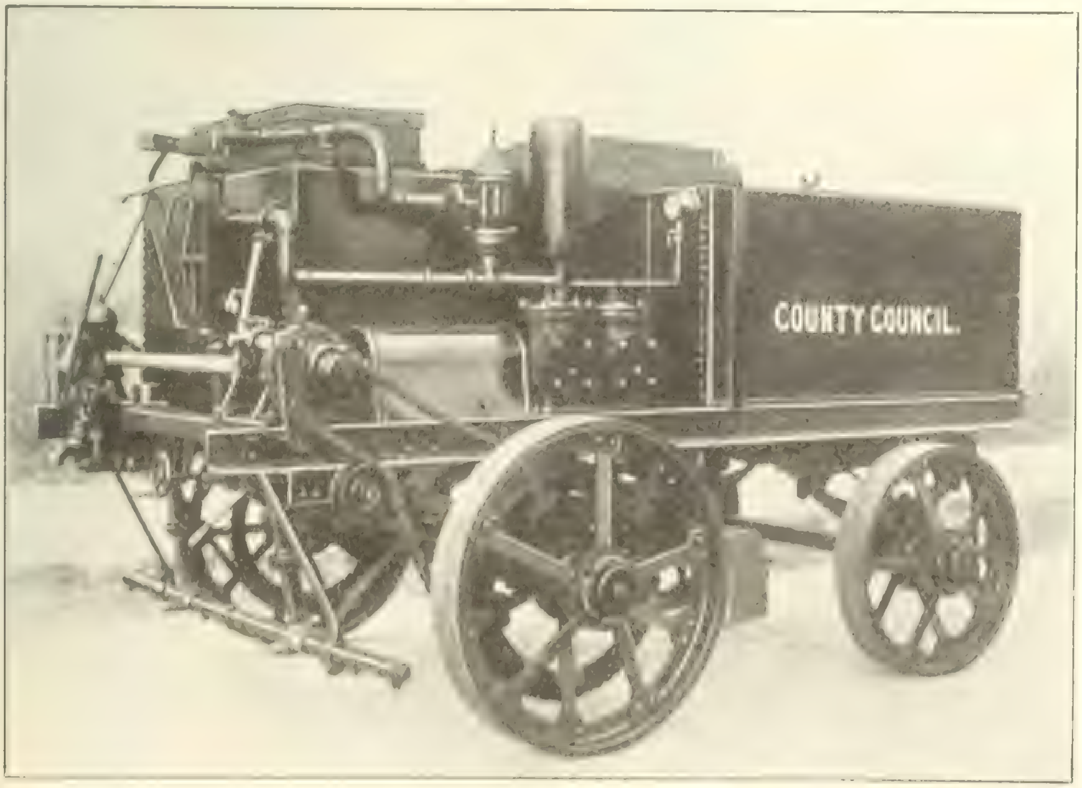

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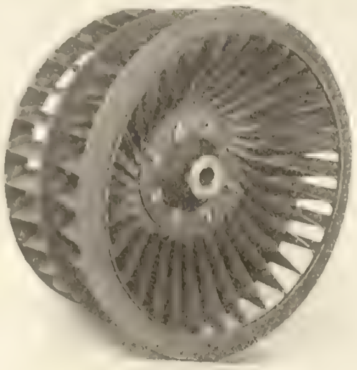

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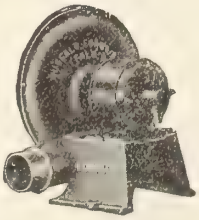

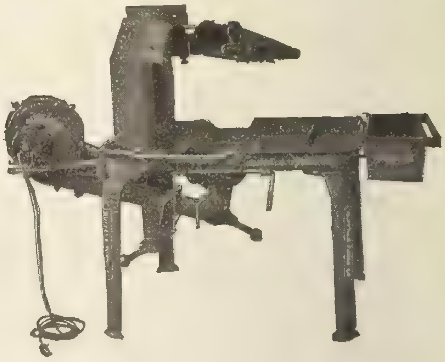

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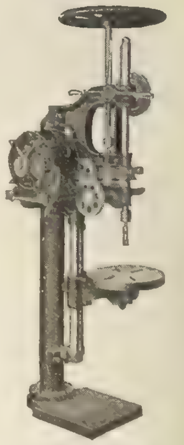

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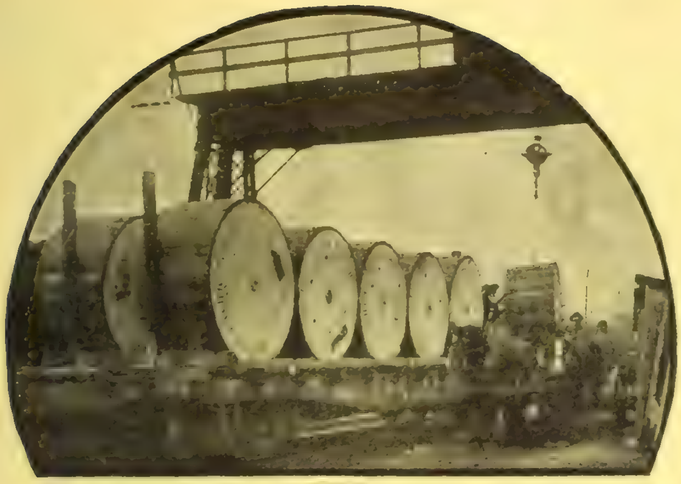

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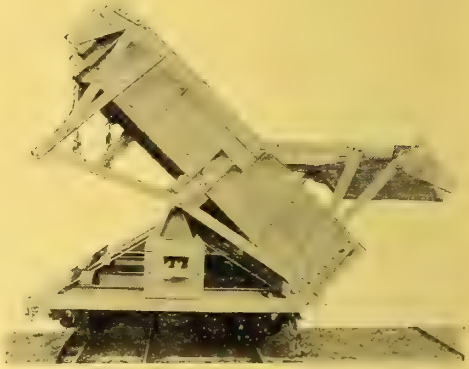

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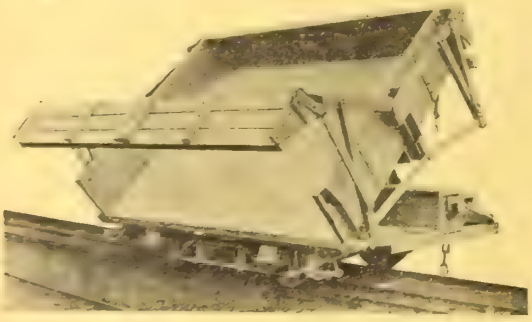

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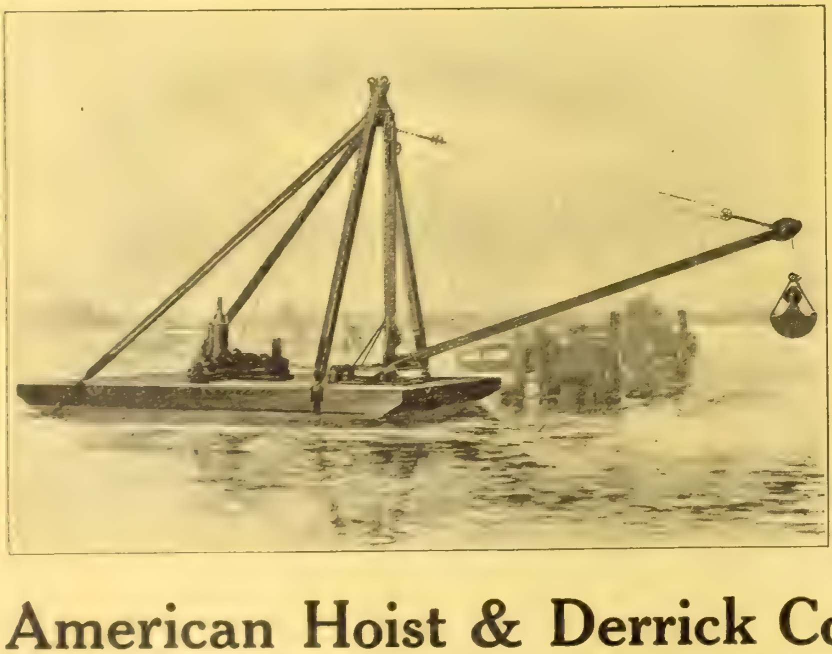
"I Don't Believe It Would Be Possible To Build A Better Barge Derrick."



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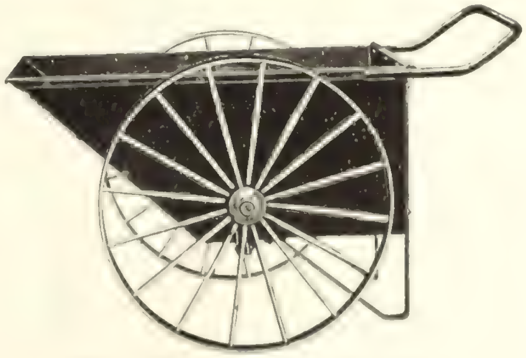

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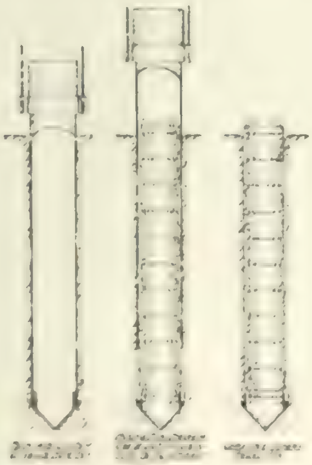
(Continued on page 12)

SIMPLEX

MOLDED INSERTED PILES

Showing molds, set up for filling, reinforcement in place; also shows molds removed. This is an illustration of casting the sections for the Simplex Molded Inserted Piles for Montreal Harbor Commissioners' Elevator No. 1.



THE SIMPLEX MOLDED PILE

for foundations for docks, wharves, sea-walls, etc., or for foundations through wet peat, or where very soft conditions prevail. The Standard Simplex forms with the Cast Iron Point is driven to the required penetration as in the Standard System. A small quantity of soft concrete is introduced through the form, and on this as a bed, a molded reinforced concrete pile is lowered through the form, which is then withdrawn leaving the molded pile in position.

Concrete Piles

The Simplex method of driving concrete piles (as outlined in the lower illustration) is different from all other methods. It eliminates the old necessity of jetting which was often difficult and always undesireable.

Simplex piles are driven to hard pan or bed rock making an absolutely non-settling foundation.

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Simplex Concrete Piling Company, of Philadelphia

Canadian Representatives

SIMPLEX CONSTRUCTION COMPANY, LIMITED

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MONTREAL

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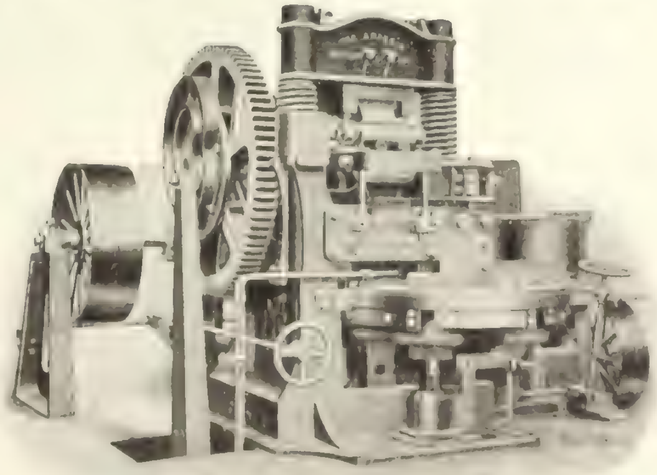

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Clinker,

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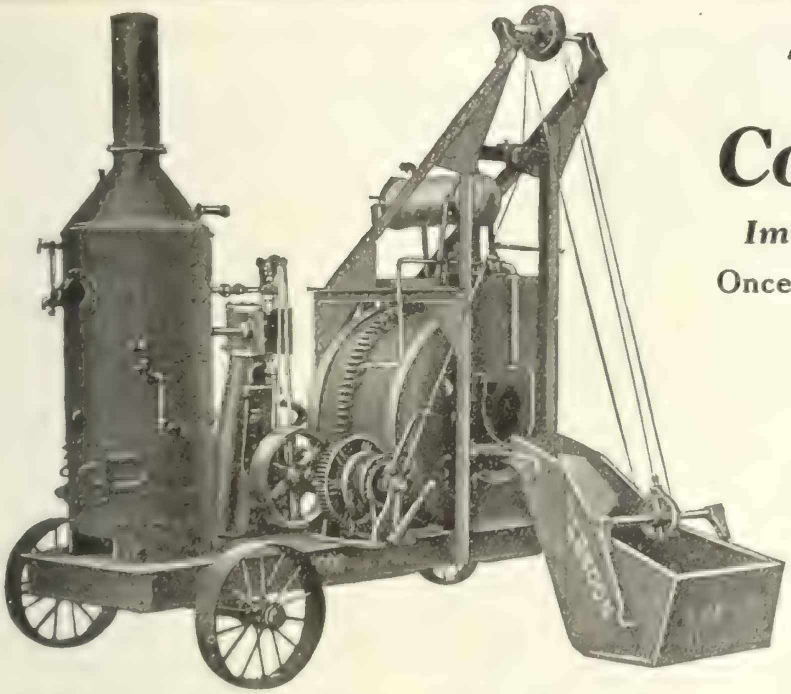

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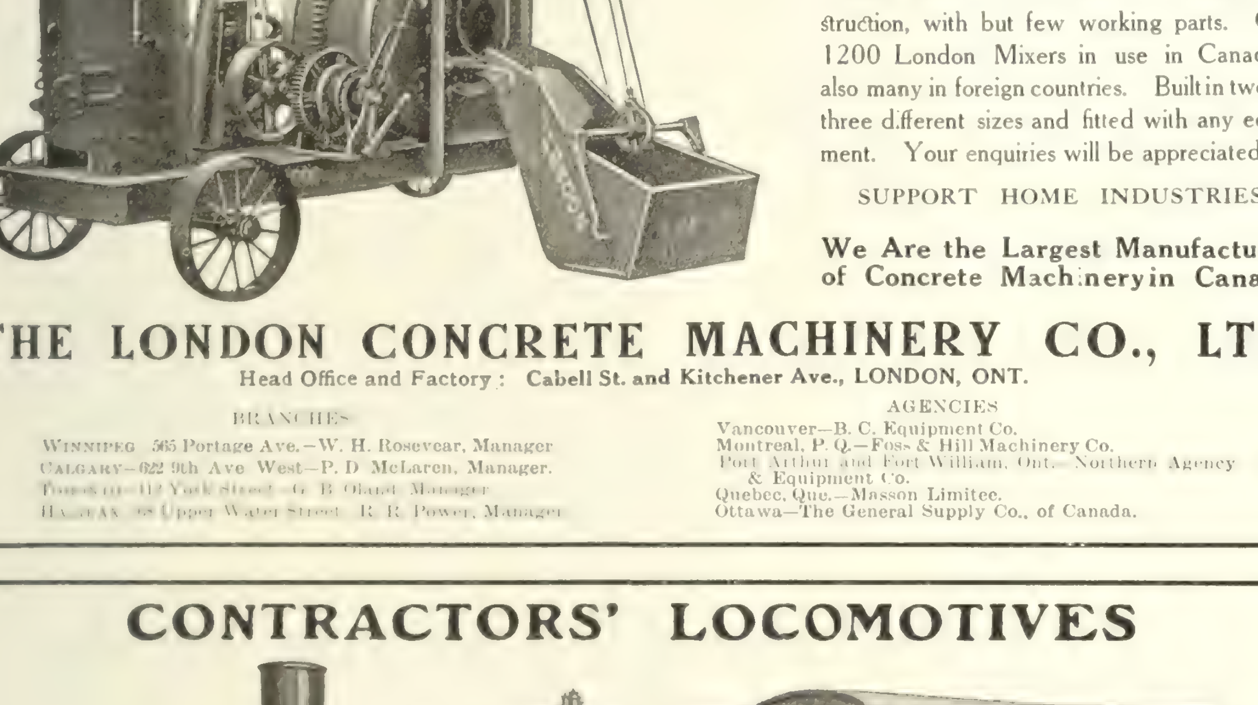

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years' experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

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TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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  Deere Plow Co., John

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"With Compound Gear and Brake Attachment"

For hoisting or lowering ash cans, kegs, barrels, cakes of ice, etc., between cellar and sidewalk, there is no known contrivance that will do the work so economically, so speedily, so safely, as

The G. & G. Telescopic Hoist

(PATENTED)

¶ When not in use, no part shows above sidewalk.

¶ The operator when using hoist, stands on the sidewalk, thus protecting the public against falling into shaft, and avoiding danger of injury to himself by the falling of a heavy load.

¶ With this hoist, one man can raise a maximum of 500 lbs. at a speed of 30 feet per minute.

¶ Exceptionally strong in construction. Very rigid when erected.

¶ The powerful all-steel brake attachment, permits perfect control when lowering heavy loads.

¶ Very easy to erect and takes up practically no room in the basement.

¶ Adaptable to any building—old or new.

☛ *Made in Canada for Canadian installations.*

☛ *Write to nearest Agent for illustrated booklet and prices.*

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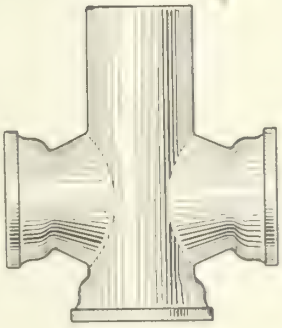

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Prompt shipments.

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Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

Macadam Roads

must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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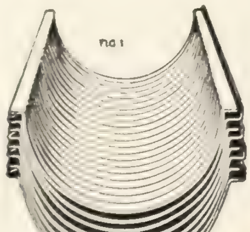

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Easy to Instal

MUNICIPALITIES will find it convenient and economical to always carry a stock of

Pedlar's "Perfect" Corrugated
NESTABLE CULVERTS

Made of Anti-Corrosive TONCAN METALS

They have just the same strength as the rivetted type, and are 29 times as strong as a plain, round pipe of similar guage. May be transported with ease in an ordinary spring wagon, and put together by one man right on the job.

The close nesting of the sections saves a considerable amount of freight, and all waste is done away with because the nestable culvert can be stopped off at any section (about 2½ feet in length).

36" PEDLAR TONCAN METALS CULVERT
Used as Town Sewer at Oshawa

PEDLAR'S PERFECT RIVETTED Culverts are made from the same special metal, and have been installed by many Municipalities, County Boards, and Railroad Companies with complete success.

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All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

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Section of Canadian Pacific Railway Terminals TORONTO

Structural Steel painted with "SUPERIOR GRAPHITE PAINT"

WHY?

Because Architects and Engineers know it's "A LITTLE BETTER"

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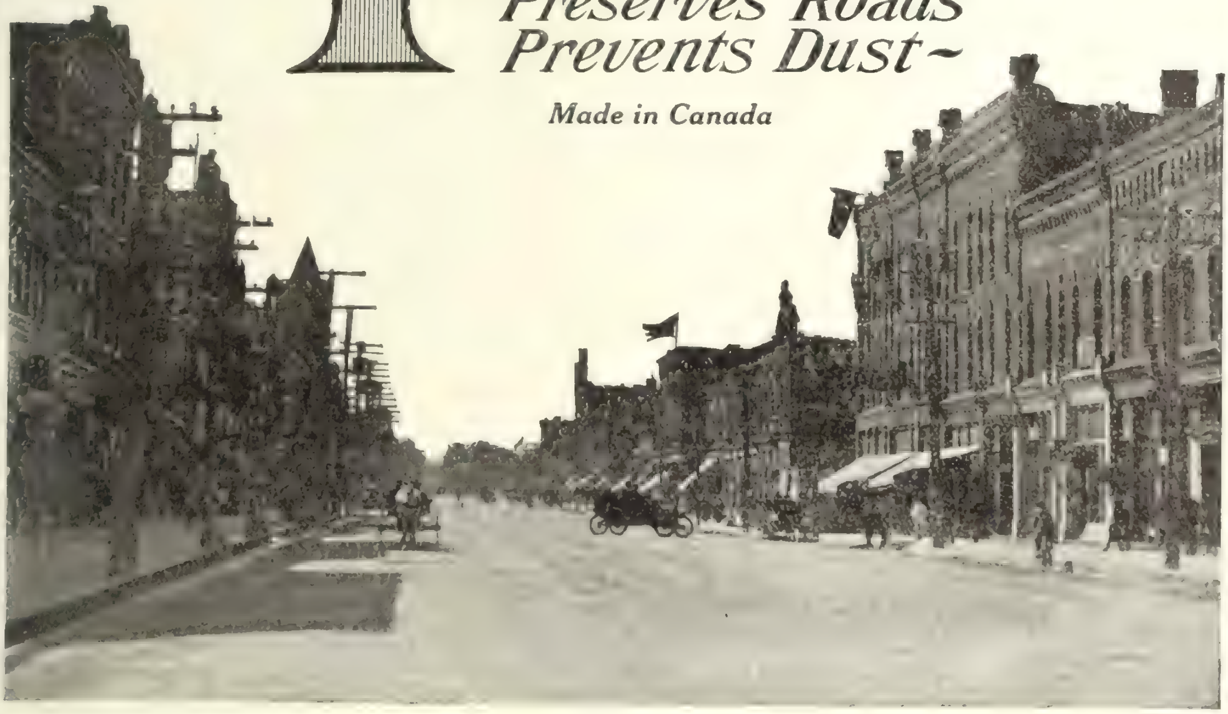
Preserves Roads
Prevents Dust~

Made in Canada



Hurontario Street, Collingwood,
Ontario, Canada.
Treated with "Tarvia B".

"Has added years to the life of the street"

MANY progressive Canadian towns have found that ordinary macadam is unsatisfactory under automobile traffic, but that its resistance to wear can be much improved by the use of "Tarvia B". This material has been used on plain macadam and on streets which were built with tar binder and needed touching up.

Mr. W. A. Tom, Reeve of Collingwood, writes:

Collingwood, April 13th, 1914.

The Paterson Mfg. Co., Ltd.,
Toronto, Ont.

Dear Sirs: Last year the town of Collingwood purchased a tank car of "Tarvia B" and applied same on Hurontario Street, early in summer. The single application kept the street in excellent shape during the entire season; it has added years to the life of the street, no mud, no dust, and clean in wet weather. We are going to use more of it this year. All are in favor of it. Yours very truly,

(Signed) W. A. TOM, Reeve,
Collingwood.

"Tarvia B" is a special preparation of coal tar, which may be applied to the road either by hand or from some form of modern power sprinkler. The Tarvia percolates into the surface and hardens, forming a tough surface binder. The treated surface sheds water, resists raveling and automobile traffic, and prevents the formation of dust. As a method of maintenance, periodical treatment with "Tarvia B" is inexpensive and highly satisfactory.

A more thorough method of preserving roads is to build them with Tarvia throughout, in which case the denser grades of Tarvia are used.

Booklet on request. Address our nearest office.

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MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
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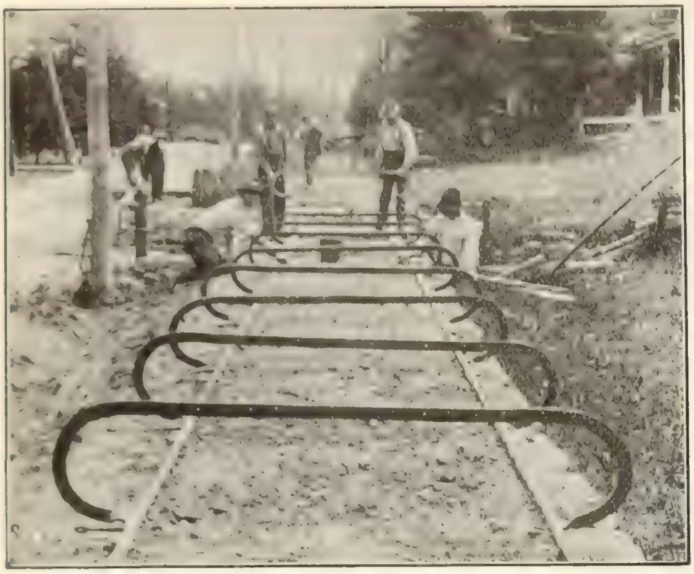

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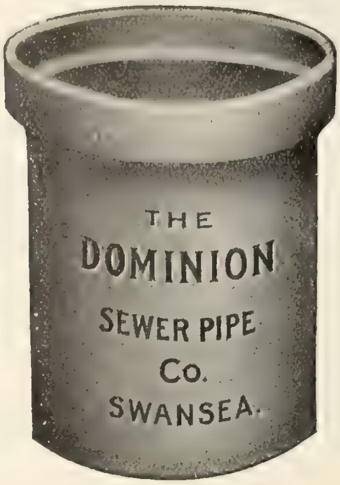

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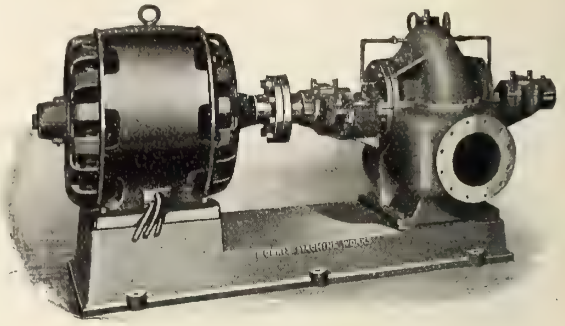

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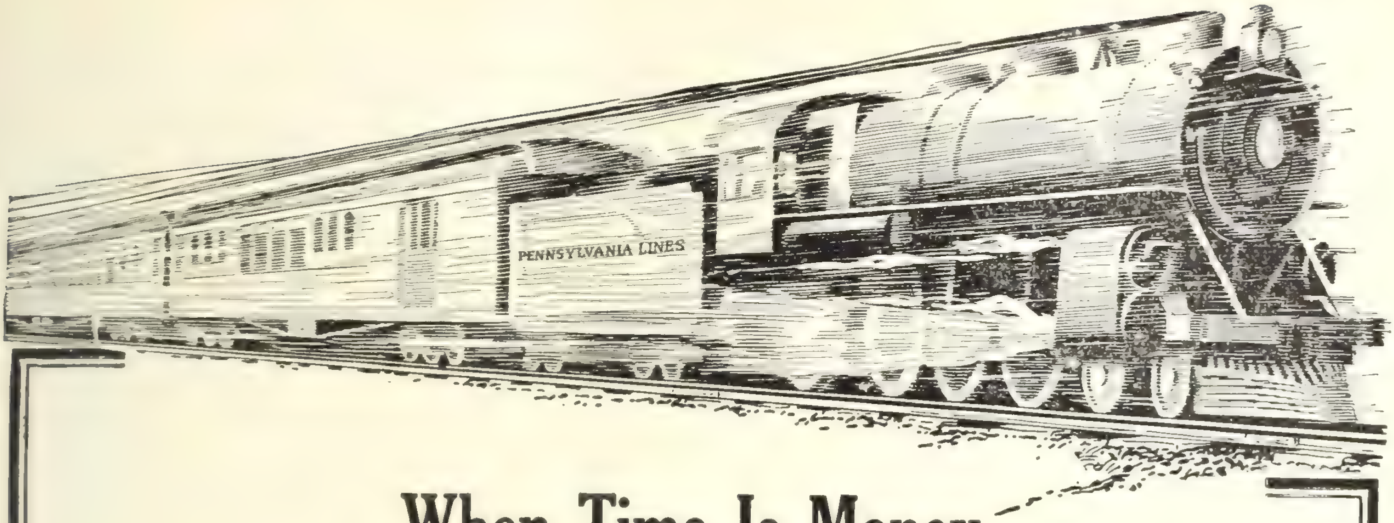

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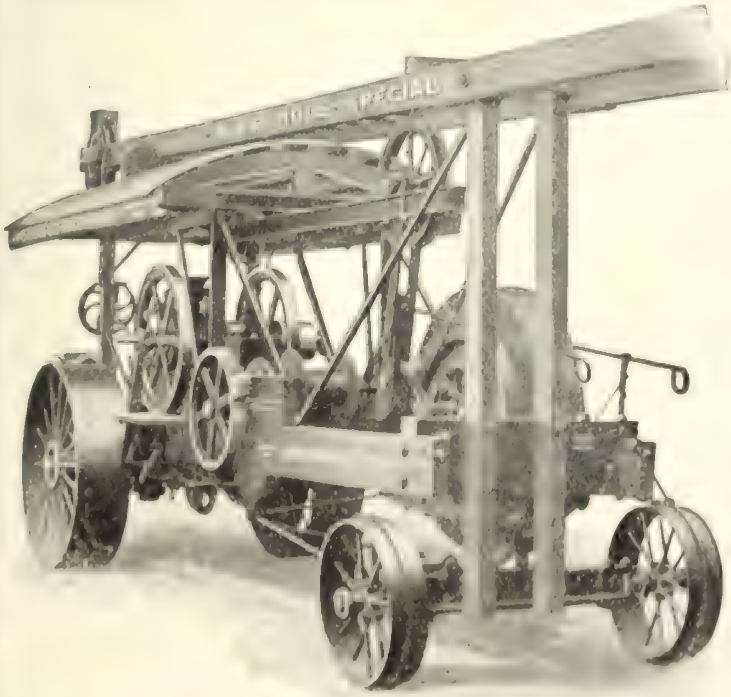
We could not afford to give you our guarantee nor put our name on the machine if the Armstrong Special would not deliver all that we claim and more.



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In Professor Hatt's report to the Society the following oustanding features are commended upon:—

1. The rail steel **showed an excess ductility** for its strength above the usual grades of steel.

2. 97 per cent. of the plain and deformed bars under ¾-inch bent cold to 180 degrees, and 97.6 per cent. of the bars ¾-inch and over bent cold to 90 degrees.

3. **The material showed remarkable uniformity,** as 80 per cent. of the bars did not vary more than 12 per cent. from the mean tensile strength. (Professor Hatt says that the variability of high carbon billet steel used for reinforcing bars should be known for comparison, but unfortunately no such data was available). The veriability of 12 per cent. in the mean corresponds favorably with the specification limits of from 55,000 to 70,000 pounds per square inch set for the tensile strength of structural steel reinforcing.

4. Professor Hatt says that it was apparent that the process of manufacture had **raised the mechanical quality of the material.** In this connection, it must be remembered that the material to begin with was of the best, as rails, of course, are always made of the highest grade steel.

We would be pleased to submit a complete copy of Professor Hatt's report and to go into the whole subject in great detail with any engineer, architect or contractor who may desire further information.

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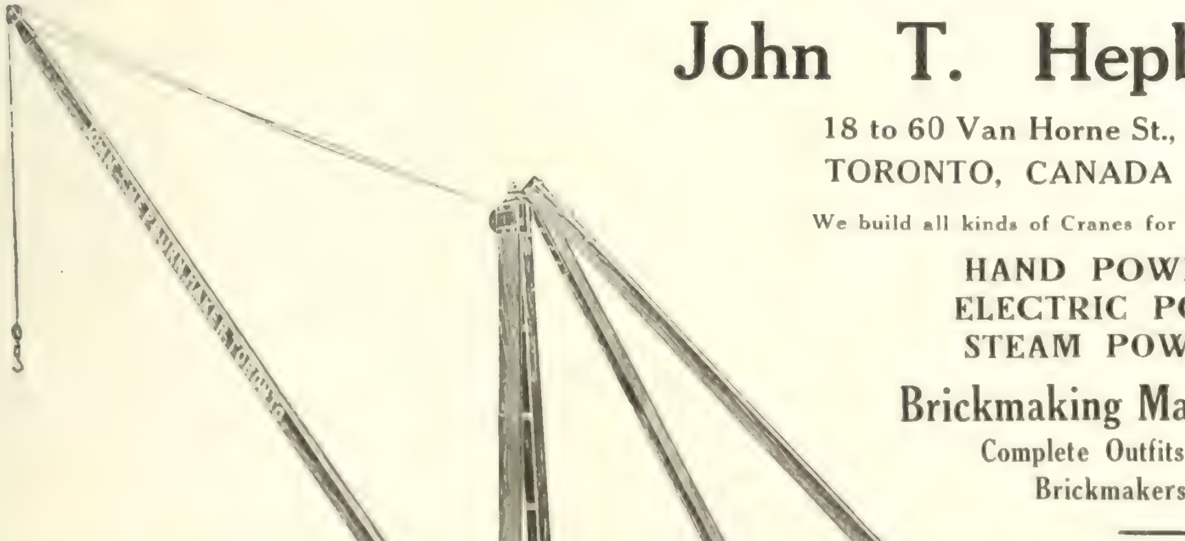

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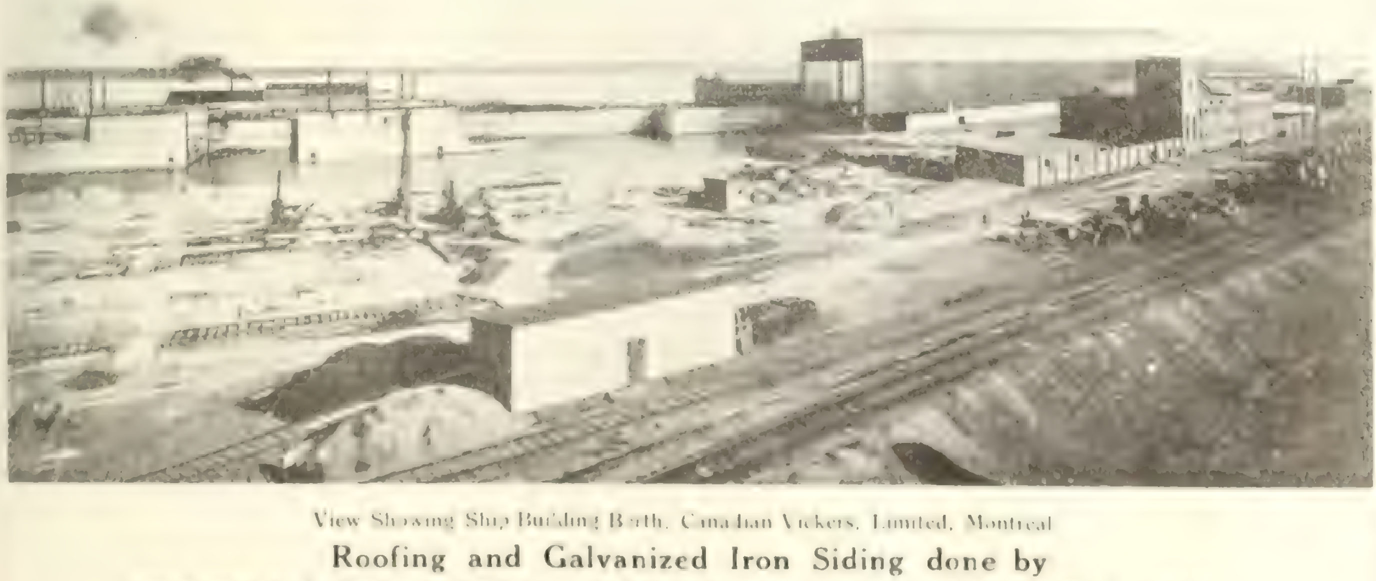

View Showing Ship Building Berth, Canadian Vickers, Limited, Montreal

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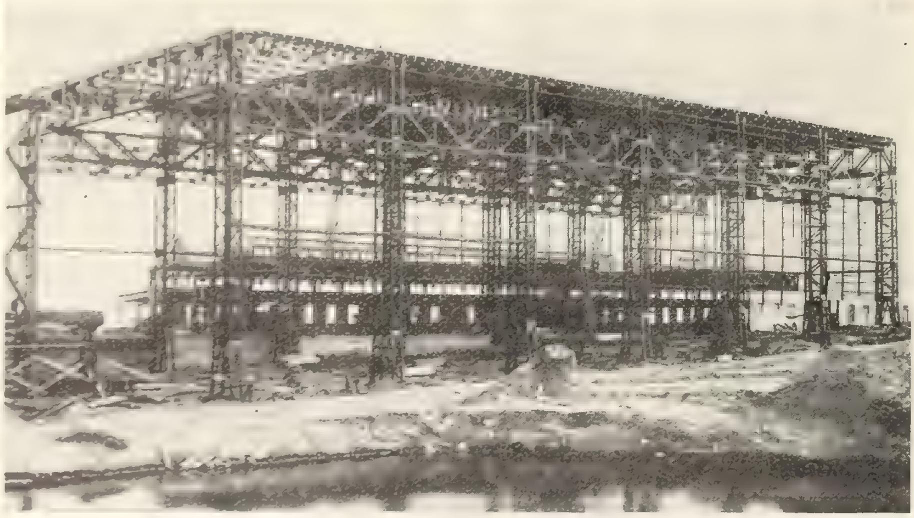

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The Day of the Capitalist and the Prospective Builder

It is not a far cry back to the time when capitalists and prospective builders were postponing their constructional enterprises owing to the high cost of building. Yesterday, as it were, the brick manufacturer, the supply dealer, the mechanic and the laborer had it all their own way. Brick-makers filled orders as a favor, supply dealers admitted of no cut except to "friends in the business," and mechanics and laborers stood unflinchingly by the arrangements made by their unions. These men, during a period of unexampled prosperity, had established themselves in a position of supremacy. Now, however, the fortunes of war and business fluctuation have changed everything and the old order has given place to the new.

To-day, of all times in recent history, is essentially the day of the capitalist. No longer does the prospective builder have to use persuasion to get the contractor to figure on his building or the brick manufacturer to provide regular deliveries to keep the work going; nor has he to speculate as to the attitude of labor. Any man with capital at the present time has the opportunity of his life. If ever he had an idea of undertaking new work or constructional extensions and he does not get his operations under way now, he will only regret it once—and that will be all his life.

It is a hard admission to have to make, but builders and contractors are now figuring to a hair's breadth on new work. With the outlook of winter before them and a quiet period behind them it is only natural that they should exert every effort to obtain work which will assure a busy opening in the spring. There was never a time when contractors and builders showed such enterprise in following up their opportunities. Looking ahead to the period of activity that must follow the cessation of activities, it is hard to imagine that in our day these men will ever be found so approachable again.

Time was when we heard of collaboration among contractors. According to some people, never a job was estimated but a certain coterie, in which Brown and Smith always figured, had their heads together in a comparison of figures. But things are no longer "fixed" between Brown & Smith. Brown might have made a little money in good times, but it is all "tied up." Smith has had a few bad "bumps." Brown has to live; so has Smith. The Brown-Smith partnership is dissolved by common consent.

We referred above to the reduced price of the materials of construction. Perhaps a few hard facts will bring this home more clearly to the man with money. In the last six months the price of building materials as a whole has steadily gone down, due in part to depreciation in constructional work, but more particularly to decline in speculative building. The reaction caused by these factors in the situation has resulted in important changes in the labor market. The demand for both artisans and laborers has eased off considerably, and labor, which not so very long ago was at a premium, is now at a considerable discount. With these facts in mind it were almost superfluous to emphasize the unique advantages which to-day lie at the very doors of those who are in a position to prosecute building work in anticipation of the boom in industrial activity which is certain to come after the conclusion of the war.

To cite a few examples of downward tendencies in building supplies, it may be pointed out that brick, the staple product in the building trade, is available at the present time on the most reasonable terms that have been met with for a long time. In the last six months quotations for common stock brick have dropped $1.00 to $2.50 a thousand, while the reduction in several other kinds is even more pronounced. Cement and lime fluctuate very slightly at any time, but crush stone has dropped 5 to 15 cents in the same period. Hydrated lime to-day is nearly a dollar below its price six months ago, and products such as paints and oils have fluctuated considerably. With these facts before us, taken in conjunction with the general situation and the evidences of trade revival at hand, we cannot arrive at any other conclusion than that the present [illegible] an opportunity almost unique in the history of this country for the judicious investment of money in constructional works.

It may be argued that we have admitted the weak position of the interests whom we are called upon to serve. This may be so, but in any event weakness may become strength under skilled treatment, and we believe that a candid admission of the situation, with an honest effort to improve business conditions to the mutual advantage of the contractor and his principal, will contribute considerably to improving the general status of conditions.

Engineering Topics In The Old Land

The Institution of Civil Engineers: Mr. Blyth's Presidential Address—Kaiser Wilhelm No Longer an Honorary Member — "Damned Little Dots" in Engineering Reports

Special London, Eng., Correspondence of the Contract Record

London, Eng., Dec. 1.

THE inaugural address of the newly-elected president of the Institution of Civil Engineers is regarded in the Old Country as an important annual event. The instituton is certainly father of all other bodies of its kind, and even on the score of age alone it is entitled to the respect and good wishes of all members of the engineering profession. The new president is Mr. Blyth, a Scotsman, and although by no means the first of that persevering and thrifty nation to occupy the presidential chair, he is the first engineer practising in Scotland to be thus honoured. As it happens, however—and the point would appear to have been overlooked by Mr. Blyth —the institution is not a Scottish body. It is essentially British, and the greater is generally understood to include the less. As a British institution, a president in his address deals usually with British engineering, and does not confine himself to that portion of the Empire in which he has been raised. Mr. Blyth, however, took as the general subject of his address the progress of engineering in Scotland during the last half century, and it is to be hoped that, in the exercise of the important duties which he will be called upon to perform during his year of office, he will shake himself free from this parochialism. One of the most interesting duties of an occupant of the chair is the handing out of work to the satellites that revolve around it. This again is handed out to the lesser satellites, and from them to the bottom dogs who live upon what morsels of fat may be thrown to them. Scotland has conquered England years ago, not by force of arms, but by intellect, persistence and adaptability. Fleet Street is merely a Scottish colony, and every newspaper office is a receiving ward for needy "brithers." Westminster is now undergoing the process of annexation, and unless Mr. Blyth uses wisely and broad-mindedly the great powers vested in his office, the capitulation of the hard-pressed English garrison is certain.

An Engineer de Luxe

An early duty of the Institution should be the revision of its list of members. In the list for 1914, the first name among the honorary members is "His Imperial Majesty Wilhelm II., German Emperor and King of Prussia," and it would be interesting to know what qualifications he had for election. To think oneself an engineer is not to be an engineer, and there seems to be no reason in the election even to honorary membership of men who are not engineers. "Honorary members," say the by-laws of the Institution, "shall be either distinguished individuals, who from their position are enabled to render assistance in the prosecution of public works, or persons eminent for science and experience in pursuits connected with the profession of a Civil Engineer, but who are not engaged in the practice of that profession in the United Kingdom or its dependencies." Surely the ability to render assistance in the prosecution of public works should not be a sufficient qualification, as judged by this standard a banker, a financier or a moneylender would be eligible in the highest degree. Wilhelm II. has, however, now been expelled from the roll, "by unanimous vote," but whether this vote includes that of sundry other undesirables history does not say. Anyway, the Kaiser has been saved the trouble of "notifying in writing" his recent many changes of address, although he has no doubt been annoyed by the "miscarriage of the publications and other communications from the Institution." To put the matter in a nutshell, an engineering institution is for engineers, and none other should be admitted. Another matter calling for attention in connection with a revision of the roll was referred to by Mr. Blyth in his presidential address, but it is difficult to see what can be done, even were action desirable. Members are not allowed to advertise, as is well known, and it has grown into a common practice for companies served by members to use the names of such members in their advertisements. That the question is receiving the "most anxious consideration of the council," one can quite understand!

The Unnecessary Decimal

The High Road, Chiswick, is one of the great western arterial roads radiating from central London, and the surveyor to the urban district council has recently taken a traffic census on the lines laid down by the Road Board in connection with the classification of roads. The census extended over one week of seven days, from 6 a.m. to 10 p.m. each day, and if any proof was wanted of the rapid increase of motor traffic in London during recent years it is to be had here. The following are "average number per day" figures: Motor cars, 1,447.48; motor omnibuses, 976.71; motor vans, lorries. tractors (excluding trailers) and traction engines, 350.27; motor cycles. 197.14; giving (with trailers) a total of 3 010.85. In addition to this electric tramways totalled 1.235.42. The total number of horsed vehicles was 2,065.0. of which horsed omnibuses were responsible for the very modest figure of 1.71, while of horsed tramways there were none. Had the census been taken in, say, Knightsbridge—which is a continuation of the same road, but much nearer central London—the preponderance of mechanically propelled traffic would have been infinitely greater. In dealing with figures such as these the decimals seem redundant. The figure for horsed omnibuses might just as well have been 2 as 1.71, and the same applies to the figure for "sheep and pigs" the average number of which is also 1.71 per day. The one would be quite as near in the average of a year of weeks as the other, and while the mind can conceive the daily passing of a sheep or a pig it cannot visualize the passing of .71 of either animal. A traffic census on precisely similar lines is to be taken in every city, town and district throughout the country, and the returns would be much simplified if "those damned little dots" were dispensed with.

A Superfluous Damp Course

Happily, the concrete raft which covers the site of the new London County Hall has escaped the observation of the irresponsible journalist. This raft is of concrete, 5 ft. thick, and would form an excellent base for German guns! Its surface is 3 ft. above low water level in the Thames, and by simply knocking down the granite and concrete retaining wall (of a thickness of from 5 to 10 ft.) and diverting the flow of the river splendid "pots" at the Houses of Parliament, Westminster Abbey and other buildings could be obtained. It might be argued that the building itself would have to be removed, but there is no possibility of this being erected until long after the termination of the war—if matters progress at the same rate as they have of late. There is one interesting point about this raft. It consists of five 12-in. layers of concrete (six parts of aggregate to one of Portland cement) and from it all walls are carried up direct, without the intervention of footing courses. Upon the first layer of concrete, 1 ft. thick, a ¾-in. dampcourse (of one part Portland cement to one part sand) is spread, and the remaining 4 ft. is then added, giving a total thickness, it would seem, of 5 ft. 0¾ in. The question is: What useful purpose will this dampcourse serve? Everyone knows that concrete is never absolutely impermeable, no matter what care may be exercised as regards its composition, mixing and laying. But then, is a ¾-in. layer of sand and cement impermeable? The bottom of the concrete is one foot below low water level and 20 ft. 6 ins. below high water level, and one cannot but think that any upward pressure of water arising from such conditions would as easily force a ¾-in. cement dampcourse as a 5 ft. cement concrete raft. Any cracking of the concrete, too, would mean cracking of the damp course. A more effective treatment (to cite only one method) would surely have been to regard the vault, i.e., the space between the raft and the ground floor of the building, as a tank and to have given it an asphalt lining. The usefulness of a cement dampcourse in such a position is quite hypothetical, and it was a wise precaution to add a further dampcourse of asphalt, ½-in. thick, to all piers and walls, at a height of 1 ft. 6 ins. from the surface of the raft.

A shortage of potash exists owing to the interruption of imports from Germany, according to the Sydney Cement Company. The company claims that many of our soils have a good supply of potash, available only to a limited extent because it is insoluble and that the application of ground limestone will give conditions which will render potash soluble.

The water used in mixing concrete should be free from oil, acid, strong alkalies or organic matter. Water carrying in suspension considerable quantities of mineral or vegetable matter should be rejected.

A Menace to Honest Contractors

IN a recent issue of the Secretary's monthly letter, the Master Builders' Association of Boston, calls attention, rather forcibly, to measures adopted by contractors to secure competitors' figures, and cites the following as an example.

"A general contractor's office is called up on the telephone and the statement is made that an estimate had been given by the person talking, but that the latter's estimator had gone out of town carrying his estimate book with him. He then asks if the general contractor will kindly give the amount of the estimate to the party talking, so that the latter might furnish other general contractors with a bid."

Concerning this the letter states. "The damnable practices by which honest contractors are defrauded, apparently ignoring all matters save the low bid, and by skinning and stealing, have brought the building down to a mighty mean estate."

The letter then appeals to the owners. It asks them to readjust their conceptions of competition, and to make the factors of ability of performance of work, reputation for reliability, fairness and decency of treatment as the weight against low bidding. It says that owners should bear in mind that an unscrupulous general contractor can easily take out of the owner all and more than the difference between his low bid, and that of a contractor who can not persuade himself to do unworthy things. The statement is made that competition rests upon something more significant than the difference in price or time of execution. It asks that architects urge their clients to comprehend that ignoring this fact and the persistent awarding of contracts to merely the low bidder on a job inevitably leads to the complete discouragement of those who wish to do work on the square.

It says, in conclusion, that unless a change in the attitude of owners is manifested soon the wholesomeness of the building business will be totally destroyed, and that the chief sufferers will be those who pay the bills.

A report prepared by the Illinois Chapter of the American Institute of Architects upon the problem of estimating by contractors under the present methods states that members of the Chapter investigated the office work of five representative contractors. They found that the average number of contracts estimated by each contractor in one year was twenty-two, the average number of jobs which he obtained from these estimates was ten. The average value of the time spent by the office force of each firm on each estimate, including additions by sub-contractors and material men, was $503. The Report points out that the cost of six bids on a building costing between $100,000 and $150,000 ran to over $3,000, that is, between 2 and 3 per cent. of the whole cost of the work. Perhaps in no other business to-day is so much unproductive work done at so high a cost.

Owing to the deficiency in the Ottawa water supply, the local agents of all fire insurance companies have been notified by the Fire Underwriters' Association to increase their rates from 25 to 50 per cent. All rates on manufacturing and mercantile risks are to be increased 50c. on the dollar in all new business. On residential buildings the increase is to be 25c. on the dollar for three-year policies.

General view of the plant of Messrs. Canadian Vickers, Limited.

Constructional Features of the Five-Million-Dollar Plant of Canadian Vickers, Limited

IN 1910 the Dominion Government passed an Act known as the Dry Dock Subsidy Act. This Act had for its purpose the encouragement of the construction of graving dry docks or floating dry docks, capable of taking the largest vessels frequenting the River St. Lawrence.

Messrs. Vickers, Limited, of England, were one of the first companies to contract with the Government for the construction of a floating dry dock and ship repairing plant. Messrs. Vickers, Limited, as is well known, is one of the largest shipbuilding concerns in Great Britain.

After the preliminary negotiations had been completed with the Government, a company now known as Canadian Vickers, Limited, was formed and has carried out the work described below.

A site having an area of about 40 acres located in the municipalities of Maisonneuve and Montreal, on the north bank of the St. Lawrence, adjoining the easterly limits of the habour, was selected. Work on the reclamation of the site for this enormous plant was started in 1910, and today, as the several buildings are nearing completion, it can readily be understood that this addition to Canada's long list of industries is of extraordinary value. The new plant when completed will have cost $5,000,000.

As many engineering and constructional features have developed in connection with the work, we believe that a description of the plant will be of interest. A study of the general lay-out will show that the work when completed will include the following units: Fitting-out Basin, Floating Dock, Mechanics' Shop, Joiners' Shop,. Pump House, Iron-Workers' Shed, Smiths' Shop, Plumbers' Shop, Gas Producer Plant, Shipbuilding Berth, Central Heating Station, Gate House and General Stores, Electrical Shop, Test House, Power House, Paint Shop, Boiler Shop, Engine Shop, Brass Foundry, Administrative Offices, also Garage, Ambulance Room, Stores, etc.

The several buildings are grouped on each side of the fitting-out basin and shipbuilding berth, which together divide the site. A description of each of the units comprising the entire plant follows:—

FittingOut Basin.—Length 1,000 ft., width 500 ft., with a depth of 30 ft. at the sides and 50 ft. in the centre at extreme low water level. Concrete retaining walls on each side, extending to a height of 28 ft. above water level. Width of walls on top, 12 ft. A sinking basin 875 ft. long, 150 ft. wide at the bottom, and 50 ft. deep below low water level, is located in the centre of the basin. Into this sinking basin the floating dock is lowered when about to take on a vessel. The tops of the retaining walls on each side of the basin form quays which are served by standard gauge tracks connecting with all parts of the works, and the main railway lines on the north side of the site. The concrete walls of the basin and shipbuilding berth were built by the Montreal Harbour Commissioners. The outer or harbour section of the walls, 1,200 ft. in length, built by the Commissioners, are on crib foundations. The retaining walls of the shipbuilding berth are on concrete piles of the pedestal type, 405 piles being used. About one million and a half cubic yards of earth were dredged from the river and deposited to form the site on which the buildings now stand. 45,000 cubic yards of concrete were placed in the retaining walls.

Floating Dock.—This dock, named the Duke of Connaught, constructed entirely of steel, was built at the naval construction works of Vickers, Limited, at Barrow-in-Furness, Eng., and was towed to Canada in September, 1912. Clarke & Stansfield, marine engineers, London, England, were the designers. The dock is registered at 17,963 long tons—British Board of Trade measurement. The dock is 600 feet long over all, 100 feet wide over the pontoon deck between side walls, and is constructed in three sections of 200 feet each, open at ends. From the top of pontoon deck to the bottom is 17 feet. The side walls average 40 feet high above deck. When the three sections are coupled together and operated as a unit the dock is capable of raising a vessel 700 ft. long, weighing 25,000 tons in five hours after the pumps are started. For general use one section is used for small vessels and the remaining two sections, coupled together, are kept in readiness for larger boats. In each side wall there is a working or machine deck 12 feet below the top deck of each wall. On these machine decks are located the pumps, boilers, dynamos, engines, and all machinery necessary for operation. The lower compartments in the walls below the machine decks, as well as the main pontoons forming the bottom of the dock, are flooded for the purpose of sinking. In the centre of the lower or pontoon deck is a line of keel blocks, each made up of four pieces of 12 in. by 12 in. oak spaced 2 ft. 6 in. on centres and extending the whole length of the deck. On each side of the keel blocks are the bilge blocks, short oak timbers resting on heavy box beams placed loose on the deck. Each section of the dock is equipped with mechanical shores, four in each wall, which are used for centering a vessel when being docked. On each side wall there are three working altars or platforms at 12 ft. elevations. Compressed air mains extend along each side wall at the pontoon deck level and also at a higher level. There are two steam-driven centrifugal pumps (each having a capacity of 1,500 gals. per minute) to each section of the dock. Forty-eight electrically-controlled valves are used in filling the pontoon compartments. Two 45 kw. steam-driven generators furnish the current for lighting, valve control and crane. Compressed air is supplied to the dock from the shore for the pneumatic tools. Incandescent lamps are used for lighting, those on the top decks being placed on standards. On the top of one side wall is an electric travelling crane of 3 tons capacity. The general service pumps are also fitted for fire service.

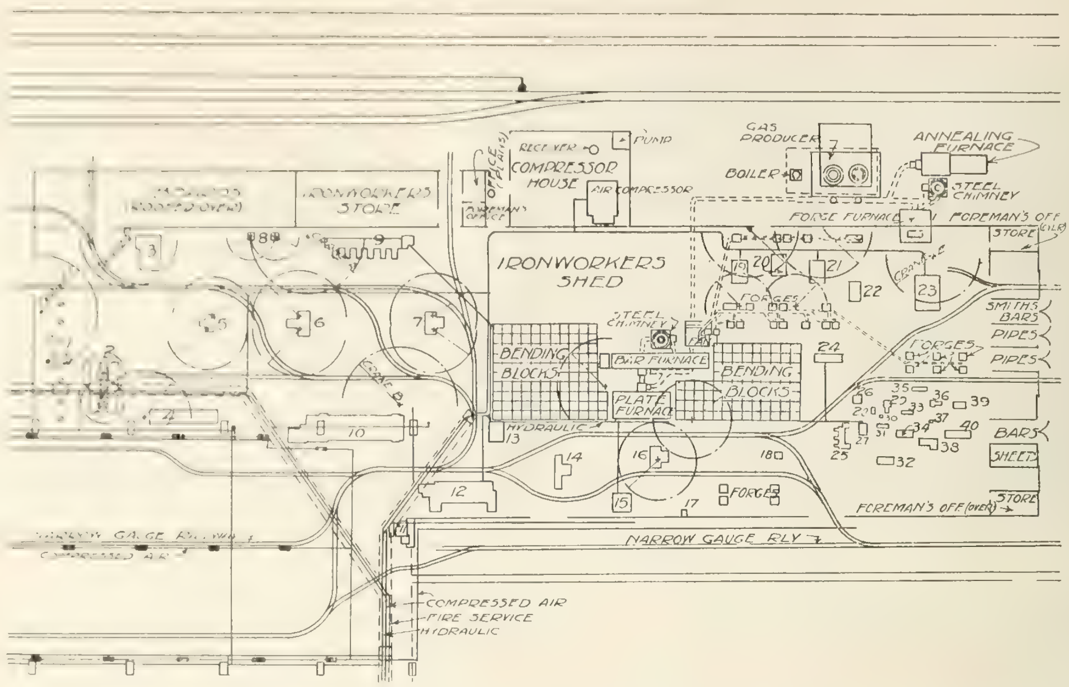
In operation, the dock is warped out over the sinking basin. The pontoons are flooded and the dock is sunk until the keel blocks on the pontoon deck are below the level of the keel on the incoming vessel. The vessel enters and is centered over the keel blocks. The pontoons are then pumped out and the dock is raised until the pontoon deck and the vessel are well above water. The dock is then warped back to the wall of the basin and made fast. Two hours suffice for the operation of docking a medium-sized vessel.

Mechanics' Shop.—This shop—one of the first to be constructed—is located close to the floating dock. The length of the main building is 100 ft. and the width 50 ft. The building is one storey high, with gallery on each side and monitor in centre of roof. The structure is of steel frame, with brick walls and ordinary windows with wooden frames. The roof is tar and gravel, Barrett specification, on double layer of pine boards carried on steel trusses.

There is an extension 90 feet x 50 feet to the east of the main building. In this are located four blacksmith forges, plate heating furnace, 20 ft. x 9 ft., coal burning, and bending slabs. The blast fans for the forges and furnace are located in the extension, also a 500 ft. auxiliary steam-driven air compressor of the Chicago Pneumatic Tool Company's make.

On the main floor of the main building the following machine tools are located: vertical drill, by Bertrams, of Dundas, Ont.; Harvey horizontal, boring, facing and milling machine; Cincinnati horizontal drill No. 3; Jones & Lamson 2¼ x 24 in. flat turret lathe; capstan lathe, used mostly for brass work; metal cutting band saw, Noble & Lund pattern; Archdale 8½ in. spindle lathe; Shanks patent double tool grinder; [illegible] patent screw forming lathe [illegible] in.; 12-in. centre lathe, Dean-Smith & Grace; Archdale radial drill, 4 ft. 6 in. arm; 12-in. slotting machine,

Canadian Vickers Plant. General Layout of Site



Ironworkers' Shed, Canadian Vickers plant.

List of Machines in Iron-Workers' Shed:—(1) multiple punch; (2) radial drills; (3) 8 ft. x 1-in. rolls; (4) 21-ft. bending rolls; (5) 1-in. punch and shear; (6) 1½-in. punch and shear; (7) 1¼-in. punch and shear; (8) radial drills; (9) 36-ft. planer; (10) 36-ft. rolls; (11) roller press; (12) Keel plate bender; (13) joggler; (14) beam bender; (15) swivel cutter; (16) 1-in. punch and shear; (17) fan from import store; (18) circular cutter; (19) 10 cwt. hammer; (20) 10 cwt. hammer; (21) 10 cwt. hammer; (22) 5 cwt. hammer; (23) 2 ton hammer; (24) hydrauilc pipe bender; (25) panel shear; (26) disc grinder; (27) hydraulic flanger; (28) emery wheel; (29) band saw; (30) motor; (31) circular cutter; (32) punch and shear; (33) 2-in. pipe screw; (34) 4-ft. rolls; (35) 4-in. pipe screw; (36) 6-in. pipe screw; (37) motor; (38) 5-ft. rolls; (39) radial drill; (40) 8-ft. rolls; (41) beveller.

Niles, Bement, Pond Company; 4-ft. radial drill, Asquith pattern; gear cutter, up to 8-in., Gleason, Rochester, N.Y.; Archdale pipe flange drilling machine; Archdale double headed shaper, 24-in. stroke; drill grinder; disc grinder; Universal milling machine; horizontal boring, milling and tapping machine.

In the south gallery are located:—metal cutting band saw sharpener, Noble & Lund, the only machine of its kind in Canada; hand-driven band saw setter; brazing furnace for making joints in band saws; high speed, Rice patent, vertical drill (spindle speed, high—2066 r.p.m., low—855 r.p.m., used for light work, 1/16-in. to ½-in. holes.

A tool store is located above on one of the galleries. In the north gallery are the detail drawing and foreman's offices. All heavy machines on the main floor of this shop are on permanent concrete foundations. All the machines except two are motor-driven from line shafts—one on each side wall. Each main shaft is driven by one 20 h.p., d.c. motor, Vickers make. One vertical drill is equipped with individual motor drive—a 5 h.p., d.c. Vickers motor. The repair work on vessels handled by the floating dock is partly taken care of in the mechanics' shop above described.

Joiners' Shop.—Two storeys and basement, length 150 ft., width 100 ft., height 33 ft. to bottom of roof trusses, on concrete foundations. Built in two bays, each 50 ft. x 150 ft., with monitor in roof over each. As this building is located on made ground, 273 concrete piles of the pedestal type were used in the foundations. The basement floor is of concrete, 9-in. thick—reinforced with Clinton wire cloth, and the whole floor slab and side walls of the basement are waterproofed. The roof is of two layers of planks, tar and gravel, Barrett specification. The main floor and first floor are of heavy pine.

The main floor is divided into four sections each 25 x 150 ft. The south section is fitted up with joiners' benches. The second and third sections contain the woodworking machinery and the north section is used as a riggers' loft.

The south half of the first floor is used as a mould loft. This loft has a level pine floor, painted black as usual. The north section of the first floor is to be a sail-makers' loft. Between the sail loft and mould loft is a space left open for the purpose of giving direct light to the main floor below.

In the basement are located a drying room and wood storage on the south side and all shafts and motors used for driving the machine tools above. The drives are grouped, one motor to every three or four machines. All motors and pedestal boxes carrying the shafts are set on permanent concrete bases. All the floors in this building are protected by a complete automatic sprinkler system of the "Estey" pattern. All windows are wired glass with "Fenestra" fireproof metal sash.

Following is a list of machine tools on the main floor of the joiners' shop:—24-in. emery wheel tool grinder, automatic, Sagar make; moulding cutter grinder, McDowell make; plane iron grinder; tenoning and scribing machine, Wadkin make; mortising and boring machine, Robinson make; 24-in. circular saw, Robinson; 36-in. circular saw, rising and falling spindle, Robinson; dimension saw (can be set at any angle up to 45 degrees)—Robinson; surface panel planer, facer and edger, Sagar & Company; Universal woodworker and pattern-making machine, Watkin, Scott & King make; spindle moulding machine, four bottom irons removable, Robinson make; band saw, Ransome make; planing and moulding machine, Ransome make; Universal woodworker, boring machine and general joiner, J. A. Fay & Egan; fret saw and boring machine—Robinson; facing lathe for iron or woodworking—Robinson; 12-in. horizontal bed lathe, 16 ft., for wood-working—Robinson; belt and bobbin sander, Sagar & Company; hand power wood trimmers—Oliver Machinery Company.

There is only one machine on individual motor drive in the joiners' shop—the Wadkins Universal Woodworker and pattern-making machine, using a 5 h.p., d.c. Vickers motor. All belting is of leather, wire laced. A complete suction system for removal of waste, shavings, etc., is about to be installed. At the east end of the main floor is located the tool room with grinders and an electric glue melter of 1 gal. capacity and a six-pot electric glue heater, both made by Ransome & Company, London, Eng.

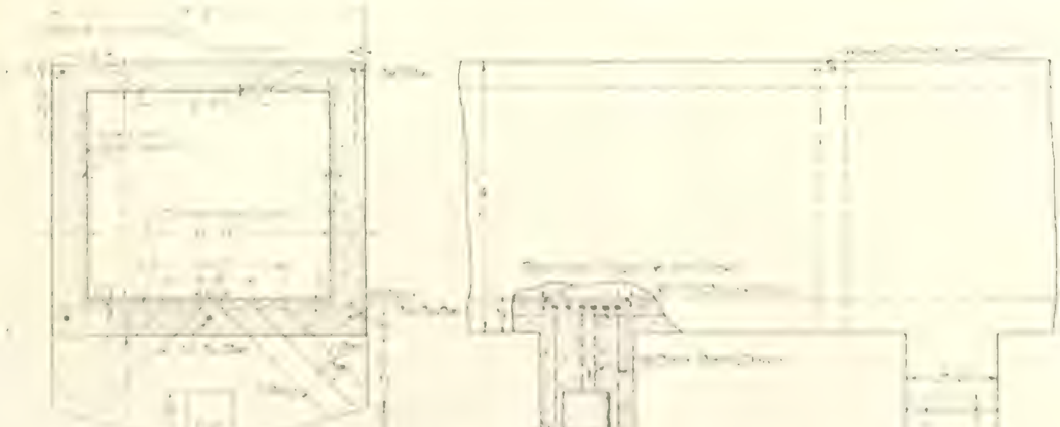
Riggers' Loft.—Beyond the usual riggers' outfit the only machine of interest in this shop at present is a Selby patent, portable, compound, hydraulic cutter, made by Bullivant & Company, London. With this machine two men can cut in 30 sections a steel cable of 7 inches circumference made up of six strands of 12 wires each, 3/16-in. diameter, made of crucible cast steel, hemp core. The ordinary method of cutting such a cable with a hack saw would take one man one hour.

Connected with the joiners' shop at the southwest corner of the building is a heating chamber, 47 ft. x 17 ft. A steam boiler capable of evaporating 5,000 lbs. of water an hour will be placed in this chamber. This boiler supplies steam to the thermotanks for heating the Joiners' Shop and is fitted with a Dutch oven extension furnace for burning refuse from the Joiners' Shop.

Iron-Workers' Shed.—One storey, constructed in three bays, two of which are 500 feet long by 50 feet wide and one 300 feet long by 50 feet wide, with monitor in roof over each bay for full length. General construction—steel frame and roof trusses, brick side walls, concrete foundations on piles. Wooden roof, made of two thicknesses, ⅞-in. T. & G. pine dressed on one side, 5-in. to 8-in. wide laid on timber purlins, 3-in. x 11-in., 3-ft. 3-in. centres, covered with 5-ply tar and gravel roofing, Barrett specification. Windows and monitor sash of steel. Monitor glazing ¼-in. rough cast glass. Window glazing of ordinary 26-oz. glass. Monitor sash controlled by Springer "Simplex" sash operators.

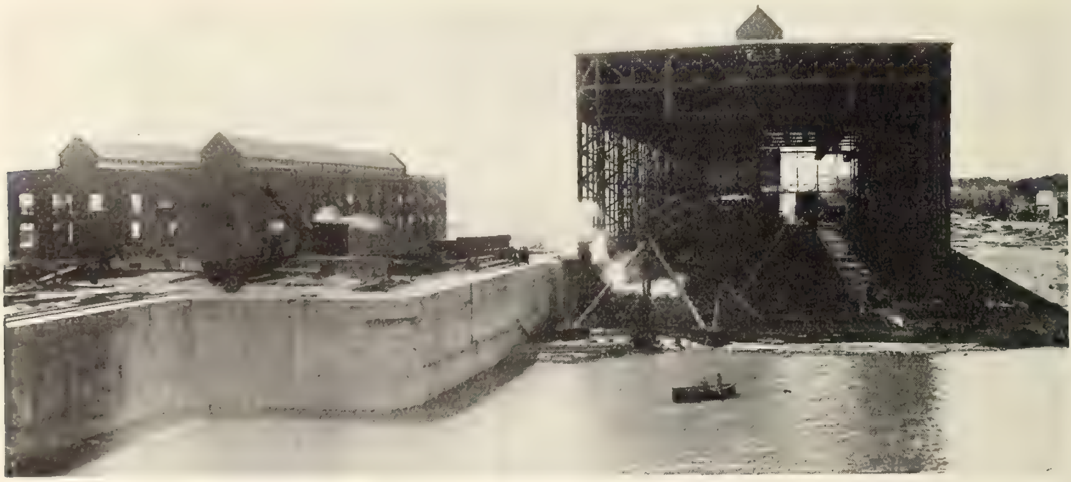
MACHINES IN IRON WORKERS' SHED

The numbers correspond to those shown on layout of this shop. A short description of some of the larger tools is given after the key number:—(1) multiple punch, automatic screw feed, length of travel 30 ft., length of machine 60 ft., capacity 25 holes in plate up to one inch thick at one operation, driven by 30 h.p. Vickers motor. (2) Two radial drills, pillar type, Asquith pattern, served by 5-ton electric crane. (3) 1-in. x 8-ft. combined bending and straightening rolls. (4) 21-ft. plate bending rolls. (5) 1-inch punch and shear (this machine is a combination of three). Punch capacity—1½-in. hole in 1-in. plate, shear capacity, 1-in. plate, manhole punch—will cut in one stroke an opening 23-in. x 16-in. in plates 1-in. thick. This machine is equipped with two 10-ton jib cranes mounted on the frame work. (6) 1½-in. punch, shear and notcher, motor driven, will cut notch or square hole 4-in. x 4½-in. Served by jib cranes attached to frame. (7) 1¼-in. punch and shear (2 punches) motor driven, served by jib cranes attached to frame. (8) two radial countersinking machines, Bertram pattern, vertical spindle attached to wall, 200 r.p.m., belt-driven. (9) 36-ft. planer. With this machine nickel steel plates up to 2-in. in thickness can be planed. The plates are held in place on the table of the machine by twelve hydraulic jacks on top of frame or by twelve screw jacks. The carriage carrying the knives is motor-driven. Travel 36 ft., 30 h.p., d.c. Vickers motor. (10) 36-ft. bending rolls. This is a large and strongly-built machine. Total weight, 240 long tons. Frame-work of double built box girders. Two motors on top frame, for moving rolls, each 40 h.p., d.c. Vickers type. Bottom rolls are 16 inches in diameter and top roll 20-in. Speed of elevating screw on fast gear 4.55 inches per minute. Slow gear 0.38 inches per minute. With this machine, nickel steel up to 2-in. in thickness can be handled. Rolls driven by 200 h.p., d.c. Vickers motor. (11) Roller press, motor 35 h.p., d.c. Vickers. Doxford make. (12) Keel plate bender, hydraulic—will bend cold plates up to 1¼-in. thick—Hugh Smith & Company, makers. (13) Lambie Joggler, hydraulic, 60 tons pressure, single cylinder. (14) Beam bender.



Typical details of reinforced concrete pipe trench—Canadian Vickers plant

Combination horizontal punch, double angle cutter and beam bender, capacity 6 in. x 6 in. x 1-in. angles, in centre, shape bender and straightener other end; makers, Craig & Donald; motor-driven. (15) Swivel cutter for cutting all kinds of shapes, mounted on turntable, hydraulic worked; the only one of its kind in Canada. (16) 1-in. punch and shear, motor-driven. (17) Fan for supplying blast to beam smiths' fires. (18) Circular cutter (cold friction saw). (19, 20, 21) Three 10-cwt. hammers, pneumatic, Pilkington Company, makers. (22) One 5-cwt. ditto. (23) One two-ton ditto. All hammer, single cylinder. (24) Hydraulic pipe bender, 60 tons pressure, Sir Wm. Arrol & Company, makers. (25) Panel shear. (26) Disc grinder, double, belt-driven, Burton, Griffiths, makers. (27) Hydraulic flange, 60 tons, capable of flanging mild steel plates 4 ft. long by ¼-in. thick; makers, Sir Wm. Arrol & Company. (28) Emery wheel, belt-driven, Churchill make. (29) Band saw, metal cutting, motor-driven; Noble & Lund make; 250 ton hydraulic press for boiler plates, by Hugh Smith & Company. (30) Motor. (31) Circular cutter. (32) Punch and shear, motor-driven. (33) 2-in. pipe screw, belt-driven. (34) 4-ft. bending rolls. (35) 4-in. pipe screw, belt-driven. (36) 6-in. pipe screw, belt-driven. (37) Motor. (38) 5-ft. bending rolls, motor-driven. (39) Radial drill, pillar type, driven by 10 h.p., d.c. Vickers motor. (40) 8-ft. bending rolls, motor-driven. (41) Bevelling machine, motor-driven; Davis & Primrose, makers.



Interior of ship berth, showing part of south wall of Basin and Joiners' Shop, Canadian Vickers plant.

Near the centre of the Iron-Workers' Shed are grouped a bar furnace and plate furnace, with steel stack and blowers, bending slabs of large area and scrieve boards. The furnaces are of the Weardale continuous regenerative type, made by the Dowson & Mason Gas Plant Company, fired by gas from producers. Bending slabs adjoining plate furnaces are of cast iron on concrete walls which form passages under the slabs giving access for cleaning away scale. The scrieve boards are 120 ft. long by 50 ft. wide, made of 6-in. x 2-in. T. & G. pine planks laid on heavy joists embedded in the earth. All machines have been placed on permanent concrete foundations, under some of which concrete piles have been driven.

At the west end of the Iron-Workers' Shed, tools and equipment for smiths, plumbers, coppersmiths and tinsmiths are located. This equipment includes a number of forges all connected with blast and suction pipes. Over each forge is a hood to which the suction pipe is connected. There are six angle smith's forges and eleven smith's forges and six coppersmith's forges—all of the Sturtevant (English) type. The blast fan is a No. 8 Sturtevant (Boston) make, driven by a Vickers 36 h.p., d.c. motor, 1660 r.p.m. The blower fans and motors are in duplicate—one set for stand-by. Near the north wall in the Beam Smiths' section are two 4-ft. x 4-ft. double pattern "Mecol" forges with hood, by the Mechanical Engineering Company, Montreal. The blast from blowers is driven by a 12 h.p. motor, 1580 r.p.m.

The plumbers and smiths' shops are completely equipped with modern tools. Near the south wall opposite the 2-ton hammer is a large gas-fired reversing regenerative forge furnace of Dowson & Mason make. This hammer and furnace are served by an electric jib crane of 7½ tons capacity. South of the Iron Workers' Shed are located the Gas Producer Plant and Annealing Furnace. At the west end of the building are stores and foremen's offices. The steel stock yards are to the west and north of the building. All parts of the shop are reached by industrial tracks. South of the shop are located platers' boards roofed over and iron workers' tool store, foremen's offices, and air compressor house. In the Compressor House there is a two-stage Canadian Ingersoll-Rand Compressor with a capacity of 2,200 cubic feet per minute at 100 lbs. pressure. This machine is driven by a 3-phase induction motor, b.h.p. 350, 60 cycles, 2,200 volts, 140 r.p.m., Vickers make. There are no overhead travelling cranes in the Iron Workers' Shed. The crane equipment includes three 7½ tons 30 ft. radius, two 7½ tons 25 ft. radius, two 5-tons 25 ft. radius, and one 5-tons 20 ft. radius, all electrically operated, of the jib type, also a large number of hand-power jib cranes, equipped with chain blocks, and all served by a complete system of narrow gauge railway tracks.

Gas Producer Plant.—Duff Pattern, 2 units, burning bituminous slack coal. Rate of gassification per unit, 7½ cwt. per hour; volume of gas 130,000 to 135,000 cubic feet per gross ton of coal. Steam used, about .5 to .6 lbs. per pound of coal consumed. Seventy-five to eighty per cent. efficiency obtained from coal. Seventy-five per cent. guaranteed. Ashes guaranteed not to contain more than forty per cent. of carbon.

The auxiliary steam apparatus consists of a 20 h.p. water tube vertical boiler.

In operating the gas producer plant the coal is fed by hand through hoppers on the charging platform.

The steel stack is 60 feet high, self-supporting, lined with fire brick, 3 ft. 9 in. inside diameter.

The entire plant was manufactured and installed complete by the Dowson & Mason Gas Plant Company, of Birmingham, England.

Ship-Building Berth.—Length over all 500 feet; width over all 132 feet; clear width between columns, 116 feet; height 100 ft. at water end and 80 ft. at shore end. Grade of floor 9/15-in. per foot. Steel frame construction on concrete foundations, and side walls which extend a few feet above grade. The walls proper to within 25 ft. of the roof are of rough glass in sheets 72-in. x 18¼-in. in steel framing of T and angle sections. For a depth of 25 ft. all round the building from the eaves down, the walls are of corrugated galvanized sheeting.

The roof is a double thickness of pine planks, on wooden purlins, covered with 5-ply tar and gravel roofing, Barrett specification. Three hundred and fifty-two concrete piles were driven under column footings and side walls of this building.

In order that work may be carried on continuously, and to prevent damage or delay when vessels are being constructed in the berth, during high water in the spring—caused by freshets or backing up of ice in the river—a movable or "flitch" dam has been constructed across the entire lower end of the berth. The top of this dam will be level with the top of the Basin walls. The foundation of the dam will consist of a mat of concrete 8 ft. deep and 29 ft. wide, properly reinforced. This mat rests on 130 piles. To prevent scouring, a single row of steel piling, of the Carnegie interlocking type, 25 feet long has been driven across the Berth 12-in. back from the outer face of the mat, and the tops of the steel piles have been embedded in the mat itself.

The framing of the dam proper is of steel, composed of standards, or posts, at intervals braced with steel struts. The standards and struts are anchored to the concrete mat. Between the standards 12 in. x 12 in. stop logs or flitches are placed. The whole front or water end of the Berth will be closed in winter by means of portable wooden panels, in angle iron framing. Size of panels 12 ft. 2¾ in. x 11 ft. 6½ in. Number of panels 50. These panels extend from top of dam to bottom chord of end roof truss. For the purpose of handling the panels and the flitches in dam below an I-beam trolley is fitted to the crane girders. The traveller is operated by a hand-power winch.

At the end of the shipbuilding shed are two slipways of timber construction, parallel and spaced 53 feet apart on centres. These ways extend 120 feet outside of the shed.

Across the entire width of the Berth, for the full length of building, 12-in. x 12-in. timbers will be laid on the grade. On these will be laid longitudinal timbers which in turn will carry the keel and bilge blocks and launchways.

The crane equipment in the shipbuilding berth includes four, each of 5 tons capacity 22 ft. 4 in. span, on each side, one of 5-ton capacity 60 ft. span in centre and one of 35 ton capacity 60 ft. span in centre, arranged in such a way that the 35-ton crane can serve the centre of either of two ships under construction side by side. Crane girders are suspended from the roof trusses. All cranes are electrically operated and all were manufactured by Sir Wm. Arrol & Company, Glasgow. Two electric winches are also installed on the slipways.

Administrative Offices of Messrs. Canadian Vickers, Limited.

Power House.—The Power House, Electrical Shop

Gatehouse, Stores and Ambulance Room. Power House and Electrical Shop to left. Canadian Vickers plant.

and Test House are all in one building: length 160 ft., width 66 ft., one storey, steel frame construction, brick walls, wooden roof with monitors, concrete foundations on 252 concrete piles. The Power House is 80 ft. long x 66 ft. wide. Tile floor on concrete base. Current is obtained from the Montreal Light, Heat & Power Company at 11,000 volts, transformed to 2,200 volts for supply of induction motors driving air compressors, hydraulic pumps, and fire service pumps and also transformed from 11,000 volts to 315 volts for self-synchronizing rotary converters, of which there are three sets, each 650 kw. speed 720, Vickers make.

There are six induction Vickers motors—two for air compressors each 350 h.p., two for hydraulic pumps each 90 h.p., two for fire service pumps each 250 h.p. General current supply for works motors, of which there are about 200, is 3 wire, direct current at 440 volts and 220 volts for general lighting. The air compressor in this house is the same as that fitted in the shipyard compressor house and is a two-stage Ingersoll-Rand unit, capacity 2,200 cubic feet of air per minute at 100 lbs. pressure, being joined up in common to one large air main through the works. All transformers are of Westinghouse make. The switch gear, both a.c. and d.c., was manufactured by Ferranti Limited, of England. There are two overhead hand-operated travelling cranes, each of 10 tons capacity, 37 feet span, Morris make. The force pumps, hydraulic accumulator and storage tank are located in the Power House. All hydraulic tools are operated from this plant. The force pumps are of the horizontal triple ram type, in parallel, automatically started and stopped by means of solenoid switches so arranged that the driving motors can be run at full speed before loading. The pumps are automatically unloaded before stopping. There are two motor-driven centrifugal lift pumps, connected in parallel, which take water from the river, raising it to the storage tank, lift about 90 feet. The water flows by gravity from the storage tank to the force pumps and is then pumped into the accumulator, in which the ballast on ram, consisting of 179 tons of slag and sand, is raised, maintaining a pressure of 1,500 lbs. per square inch in the hydraulic mains. The hydraulic mains extending to the several buildings are of seamless steel pipe with cast steel oval flanges, manufactured by Stewart & Lloyds, Scotland. The entire hydraulic equipment in the Power House was manufactured by the Leeds Engineering Company, Leeds, England.

An interior view of the Ironworkers' Shed—Canadian Vickers plant.

The Electrical Shop is equipped as follows: double disc grinder; sheet shears and rolls; wet stone; shaper, radial drill; two screw cutting lathes; large machine lathe; coil taping machine; coil winding machine; band saw for cutting insulating material; hand portable punch.

The machines are belt-driven from line shaft run by a 10 h.p. Vickers motor. In the Electrical Shop is a long work bench equipped with twelve semi-steel solid bar Parker Patent vises.

There is also an impregnating plant for treating field coils, etc., wire and cable storage room and a 3-ton hand-operated travelling crane, 32 feet span, with chain block. The floor is of creosoted blocks on concrete base and the whole shop is protected by "Estey" sprinklers.

The test house is equipped with a horizontal testing machine, capacity 100 tons, used for tension compression and bending tests. This machine was made by Joshua Buckton & Company, Leeds, England.

Administrative Offices.—Located at north-east section of site, facing Notre Dame Street. Three storeys and basement, length 120 ft., width 54 ft., fireproof construction, concrete foundations. Natural ground, no piles required. Steel frame, brick walls. Montreal limestone trimmings. Front and back of building faced with red pressed brick. Floors of "Keystone" gypsum composition reinforced. Partitions of "Keystone" gypsum blocks, wooden roof covered with 5-ply tar and gravel, Barrett specification.

The building is divided into three sections. The windows are of the ordinary type. In the east section are located stairways, vaults and chief draughtsman's offices. In the centre the main and draughting offices, and in the west section the offices of the executives, board room, dining rooms, kitchen, etc. The kitchen is on the top floor. On the roof is the sun printing photograph and electric printing frames. The interior trim is of oak and mahogany. The building is heated in winter and cooled in summer by the Carrier Air Conditioning System. A complete air washing plant is installed. The stairways in this building are of ornamental iron manufacture and are installed by the Dominion Architectural Iron Works, Limited. Stair heads are of concrete finished with Toch Bros. dust-proof cement floor paint.

Concrete Piles.—About 3,000 concrete piles of the "Pedestal" type, approximate total length 75,000 lineal feet, were used in the construction of the foundations of the buildings, retaining walls, and heavy machines, the whole of the site being reclaimed ground. The concrete piling was done by the MacArthur Concrete Pile & Foundation Company, of New York. This contract is one of the largest for concrete piles ever awarded in Canada. Each pile is designed to carry a load of 30 tons. Many tests were made under a load of 45 tons and none showed any settlement. All piles were driven to a penetration of 25 blows to 2-in. by a No. 2 Vulcan Steam Hammer, weighing 6,600 pounds; weight of plunger 3,000 lbs., drop of hammer 2 ft. 6 in. Practically all the concrete piles driven are 30 feet in length. Each pile weighs three tons and contains about two cubic yards of concrete.

Two piles were excavated during the course of the work to show the bulb or pedestal as formed by the material when actually in place. One of the accompanying illustrations shows clearly the condition of the piles.

Pile driving was proceeded with during the winter season except when the temperature was below zero. In cold weather the sand and stone were heated by steam. Concrete was mixed in a shed. Wooden covers were placed over the wheelbarrows while the concrete was being conveyed from the mixing shed to the pile-drivers.

Lighting System.—In the Shipbuilding Berth, Iron Workers' Shed and several of the other buildings, mercury vapor lamps of the Westinghouse-Cooper-Hewitt (London, Eng.) type, each of 3,500 c.p. are used. In the Joiners' Shop and around the yard about 150 arc lights of the "Monarch" type, each 600 c.p., made by Verity's Limited, Birmingham, Eng., are installed. All lights are on d.c. circuits, except those for the Administrative Offices and General Store Building.

General Heating System.—All the buildings are heated by Thermotanks, the air taken from the outside of the buildings being passed through the tanks, which contain steam coils of cast iron, by a motor-driven blast fan running at 800 to 1100 r.p.m. and being distributed in the several buildings by means of sheet metal pipes. Registers and controls are placed in the walls and outlets of the pipes. Steam is carried to the tanks from the central heating station through mains in the tunnel except for the Joiners' Shop for which a separate boiler plant has been installed.

Water Supply.—Cast iron water pipes have been extended to all parts of the plant and 22 fire hydrants of the Ludlow non-freezing slide-gate type have been installed. A connection has been made with the city main in Notre Dame Street near the Office Building and also on the river bank. West of the Joiners' Shop a pumping plant is located, the purpose of which is to maintain a pressure of 100 lbs. throughout the mains. Two pumps of [illegible] Engineering Company's make, driven by Vickers motors of 250 h.p. each, will be installed. Each pump will be capable of delivering 1,500 Imp. gals. a minute against a total head of 350 ft.

Tunnel.—There is a concrete tunnel about 3000 feet in length, extending from the engine and boiler shop. It is located on the north side of the Fitting-Out Basin around the works to the floating dock on the south side, and connects all the buildings. The inside dimensions of the tunnel are 6 ft. x 6 ft. The bottom and top slabs are of concrete. The top slab is reinforced with Clinton Wire Cloth. For the whole length of the tunnel on 10-ft. centres, heavy concrete girders, resting on concrete piles, have been constructed in the floor slab. The entire tunnel structure is below frost level. Manholes are located at intervals. A typical cross section is shown.

Interior of Electrical Workshop—Canadian Vickers plant.

The tunnel is used for the purpose of carrying water, steam and air mains, and electric cables, a 12-in. cast iron fire service main, 2½-in. hydraulic high pressure main, 5-in. heating main with 4-in. return, 8-in. compressed air main, 4-in. drinking water main, 10-in. steam main, at 200 lbs. per square inch to Engine Shop for testing steam turbines. All electric cables will be supported on porcelain insulators.

Pneumatic Equipment & Tools.—Two Compressors, Canadian Ingersoll-Rand Company's make, one in Compressor House and one in Power House, of capacity already given, connecting to a common 8-in. main which completely encircles the works, with branches to each shop and department, have been installed. In particular the floating dock has 240 connections, and the ship berth 300 connections. The pneumatic and electric tools used throughout the works were manufactured by the Chicago Pneumatic Tool Company.

New Boyer Rivetting Hammers Nos. 60-80 and 90 are being used in conjunction with Boyer standard Short Holders-on and Boyer Combination Holders-on for driving rivets in boiler plate and for general work of this nature. Special Short No. 50 Boyer Rivetting Hammer with inverted handle is being used for rivetting in the bows of boats where space is limited.

Interior of Joiners' Shop—Canadian Vickers plant.

"New" Boyer and "New" Chicago Chipping Hammers are being used for chipping steel along the edges of plates when required, and for caulking and general work. The "F" Boyer Hammer is used for chipping paint and scaling off the sides of boats which are to be repaired. "Little Giant" Pneumatic drills are being used for all metal boring including reaming of holes of different sizes for bolts, etc. "Little Giant" Wood-Boring machines are used for boring holes in timbers for the dock. No. 2 Boyer Rivet Buster is being used for breaking the heads of rivets condemned by inspectors. "Duntley" Electric Drills, all sizes, from the Midget drill to No. 3, are being used in drilling in all parts of the plant where air is not available. "Protector" brand hose, with woven steel armor for water, steam and air, is in use throughout the works, also a special large air hose with cotton jacket of "Protector" brand, is used for carrying compressed air from the air main to the Floating Dock. All hose was manufactured by the Woven Steel Hose & Rubber Company, Trenton, N.J.

The pneumatic and electric tools and hose above described were supplied to the Canadian Vickers Company by the Holden Company, Limited, of Montreal.

Central Heating Station.—One-storey building, 136 ft. long x 50 ft. wide, steel frame, brick walls, concrete foundation on concrete piles, mill roof 2 in. x 4 in. on edge covered with 5-ply tar and gravel roofing, Barrett specification, metal window frames. Central heating, station includes boiler plant, steam test house, economizer, conveyors, radial brick stack (Alphonse Custodis make) 175 ft. high.

The equipment includes four Babcock-Wilcox water tube boilers, 200 lbs. pressure, each having a heating surface of 3,720 sq. ft., used for heating purposes in conjunction with the thermotanks, and one boiler [illegible] similar make and capacity, pressure 320 lbs., for testing purposes. Green's economizer and chain grate stokers, coal breaker, ash handling plant, coal conveyors, capacity 40 tons per hour, all of Babcock-Wilcox make, are also installed.

The five boilers together are to be capable of evaporating, when burning 20 lbs. of slack coal per sq. ft. of grate with natural draft, 64,000 lbs. of water an hour.

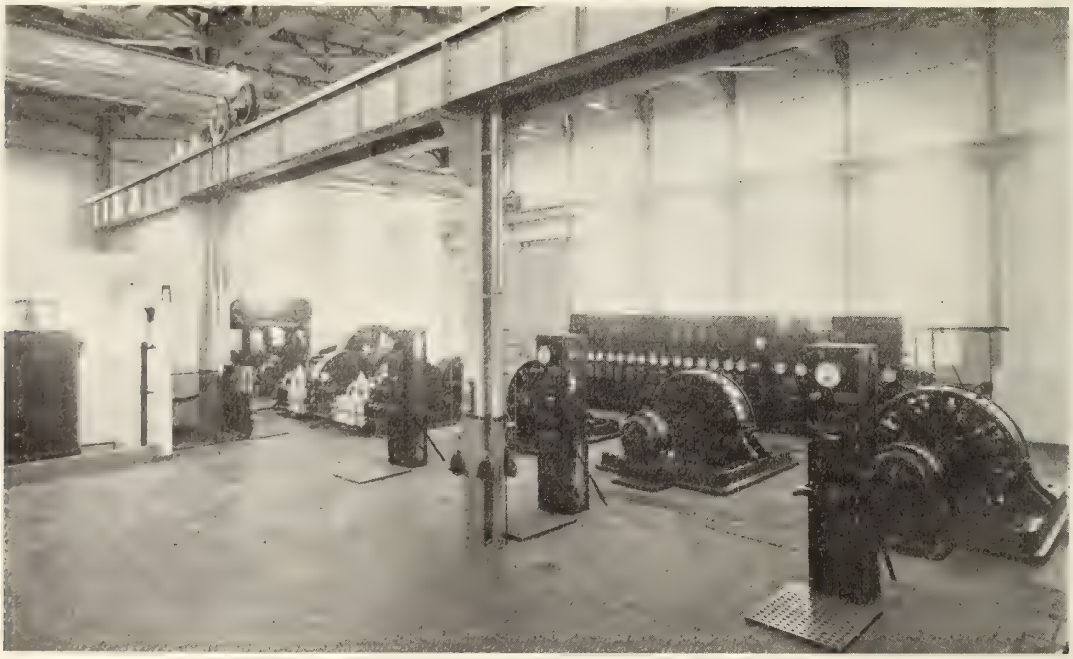
Integral steam superheaters, each having 572 sq. ft. of heating surface, one on each boiler, each superheater to be capable of imparting 150 degrees Fahr. superheat to the steam produced by one boiler. The chain grate stokers, automatic, Babcock-Wilcox type, are to be capable of burning coal, containing 30 per cent. of hydro-carbon and approximately 13,000 b.t.u. per pound of dry coal, smokelessly, and well within the requirements as regards smoke nuisance.

All valves and headers in boiler plants are of cast steel.

General Stores, Gate House and Ambulance Room.—Size of building 103 ft. long x 34 ft. wide, two storeys and basement. Steel frame, brick walls, concrete foundation on 88 concrete piles. Reinforced concrete floors designed to carry 400 lbs. per sq. ft. Reinforced concrete roof slab 4½ in. thick, on steel purlins. Ordinary windows.

Dartnell, Limited, contracted for the waterproofing of this building. The well-known waterproofing compound manufactured by the R. T. W. Damp Resisting Paint Company (Toch Bros.), was mixed integrally with the concrete in the side walls and lower floors, and a 1-in. surface coat of cement mortar made with the compound covers all exposed parts of the concrete. The lower floors are dust-proofed with Toch Bros.' filler. The building is fireproof. An Otis-Fensom Freight Elevator in wired glass fireproof enclosure is installed. The building is located at the main entrance gate of the works and in it there will be the gate office, general stores, ambulance and first aid equipment.

Engine and Boiler Shops, and Brass Foundry.—Located in one building, size—length 380 ft., width 155 ft., height 38 ft. to bottom of roof trusses. Steel frame construction, brick walls, concrete foundations on concrete piles, wooden roof covered with 5-ply tar and gravel roofing, Barrett specification. The building is divided longitudinally into three bays; widths 65 ft., 51 ft. and 39 ft. Above the narrow bay is a gallery 310 ft. long. On this gallery will be located a tur-



Interior of Power House—Canadian Vickers plant.

bine blade workshop, blading template floor, blade assembly benches, lockers for assorted blades, etc.

The west half of the building will be used as a Boiler Shop. This space is divided into three sections for boiler work, machine work and erecting. The Engine Shop will occupy the east half of the building. Two lines of standard gauge tracks will be extended through the shops. In the Engine and Boiler Shops there will be three 25-ton and one 5-ton overhead travelling cranes. All cranes are of the plate girder type electrically operated, designed and manufactured by Sir William Arrol & Company.

At the north-east corner of the Engine Shop is a brass foundry 60 ft. x 40 ft., one storey. In this foundry there will be six pot fires, emery wheel, drying store, sand shed, metal shed and coke storage.

Following is a list of machine tools and equipment in the Boiler and Engine Shops: duplex radial drill; six spindle multiple drill; elliptical hole boring machine; plate edge planing machine; thermotank, fans and motors; 24-in. double head shaping machine; pipe drilling and facing machine; "Johns" splitting shears; horizontal plate bending rolls; vertical hydraulic plate bending machine; one fixed hydraulic riveting machine; tube cutting machine; circular saw; tool grinders; screw cutting machine, levelling block; smiths' hearth; testing machine; hydraulic intensifier electro-depositing bath; motor and generator; acid pickling bath; soda washing bath; 72-in. x 72-in. x 14-ft. planing machine; compound planing machine; turbine boring machine; horizontal drilling machine, 5-in. spindle; horizontal drilling machine, 3-in. spindle; duplex radial drills; vertical drill; 5-ft. 6-in. radial drill; 72-in. turbine lathe; 36-in. duplex lathe, double header; 8-ft. chuck lathe; 14¼-in. gap lathe; 12-in. gap lathe; 36-in. circular planer; two No. 3 facing and boring machines; turret lathe; capstan lathe; profile milling machine; Universal milling machine; vertical milling machine; 24-in. double head shaper; 12-in. slotting machine; 24-in. slotting machine; wormwheel generator; bevel gear planer; screwing machine; band saw; portable milling machine; saw sharpening machine; saw setting machine; Keyway cutting machine; 28-in. disc grinder; tool grinder; sensitive drill; No. 2 facing and boring machine; 8½-in. brass finishers' lathe; 6½-in. capstan lathe; 12-in. gap lathe; 9-in. capstan lathe; 5-ft. radial drill; horizontal drilling machine; semi-automatic duplex milling machine; 24-in. shaping machine; 8-in. slotting machine; tool grinder; turbine blade press; screw press; turbine blade sawing machine; turbine blade knicking machine; No. 1 turbine blade tipping machine; No. 2 turbine blade tipping machine; turbine blade drilling machine; turbine blade rumbling machine; section washing tank; 20-in. disc grinders; sensitive drill; flanging press and fixtures.

The largest machine in the engine shop is a 36-in. double duplex patent lathe used for machining marine shafts, etc. Length of bed 113 ft., 4 carriages, 2 head stocks, 2 tail stocks, each pair driven by a 52 h.p., d.c. motor, 370 to 970 r.p.m. Vickers type. The length of foundation of this lathe is 120 ft.

Sir William Arrol & Company, Limited, engineers, are responsible for the design of the buildings. Messrs. T. Pringle & Son, Limited, Engineers, Montreal, designed the Administrative Offices, Gate House and Central Heating Station to the requirements of the Canadian Vickers, Limited.

The general contractors for the construction of the plant above described are E. G. M. Cape & Company, Limited. Following is a list of the sub-contractors for the construction work:—MacArthur Concrete Pile & Foundation Company, New York, concrete piling; Keystone Fireproofing Company, Limited, New York, fireproofing; Alphonse Custodis Chimney and Construction Company, New York, brick chimney; Robert Reid, Montreal, floor and tile work, granite; Hadrian Flooring Company, Limited, Montreal; floor and tile work; Douglas Bros., Limited, Montreal, kalameined work; Wm. Rutherford & Sons Co., Ltd., Montreal, millwork; F. Tremblay & Co., Ltd., Montreal, millwork; U. Pauze & Fils Co., Montreal, millwork; Dominion Architectural Iron Works, Ltd., Montreal, ornamental iron work; Canada Creosoting Co., Ltd., Toronto, paving blocks for floors; P. J. Sullivan & Co., Ltd., Montreal, plumbing and heating; Thomas O'Connell, Montreal, plumbing and heating; Trussed Concrete Steel Co., Montreal, reinforced steel; Dominion Bridge Co., Ltd., Montreal, steel work; Structural Steel Co., Ltd., Montreal, steel work; Phoenix Bridge & Iron Works, Ltd., Montreal, steel work; Steel & Radiation, Ltd., Montreal, steel sash; G. W. Reed & Co., Ltd., Montreal, waterproofing; Dartnell Ltd., Montreal, waterproofing; Francis Hankin & Co., Ltd., Montreal, waterproofing; Geo. W. Reed & Co., Ltd., Montreal, roofing; Richardson & Simard, Montreal, roofing; Metal Shingle & Siding Co., Ltd., Montreal, roofing; Canadian H. W. Johns-Manville Co., Montreal, roofing; Sibley & Huot, Montreal, roofing; Master Builders Co., Montreal, flooring; Pedlar People Ltd., Montreal (Oshawa), reinforcing, Clinton wire cloth; Sherwin Williams Co., Montreal, paint; La Prairie Brick Co., Ltd., Montreal, brick; Canada Cement Co., Ltd., Montreal, cement.

Fireproof partition in the offices of Messrs. Canadian Vickers, Limited.

Ahern Safe Company, Montreal, safes; Sir Wm

Arrol Company, Glasgow, heavy cranes, hydraulic presses, etc.; Babcock & Wilcox, Limited, Montreal, boilers and auxiliary equipment; John Bertram & Sons, Dundas, radial drills; British Westinghouse Co., London, Eng., Cooper-Hewitt mercury vapor lamps; Brown Hoisting Machinery Company, Cleveland, locomotive cranes; Canadian Fairbanks-Morse Co., Montreal, "Byers" pipe; Canadian Ingersoll-Rand Co., Montreal, compressors; Carrier Air Conditioning Co., New York, office ventilation and heating; Chicago Pneumatic Tool Co., Chicago, pneumatic and electric tools; Dowson & Mason Gas Plant Co., England, gas producers and furnaces; Ferranti Electrical Co., Toronto, panels; Holden Co., Limited, Montreal, pneumatic tools and armoured hose; Leeds Engineering Company, Leeds, Eng., hydraulic accumulator and ram; Ludlow Manufacturing Co., Troy, N. Y., fire hydrants; MacArthur Concrete Pipe & Foundation Co., 11 Pine Street, New York, concrete piling; D. K. McLaren Limited, Montreal, belting; Morris Crane & Hoist Co., Ltd., England, chain block and travelling cranes; Office Equipment Co. of Canada, Montreal, furniture and office equipment; Otis-Fensom Elevator Co., Ltd., Montreal, freight elevators; C. Parker Company, Meriden, Ct., patent vises in electrical shop; Paterson Manufacturing Co., Toronto, roofing materials; P. Pilkington & Co., England, pneumatic hammers; Pulsometer Engineering Co., Reading, England, pumps; Hugh Smith & Sons Co., Glasgow, bending rolls, etc.; Springer Lock Co., Belleville, monitor sash operators; Stewarts & Lloyds, Glasgow, steel high pressure pipe; B. C. Sturtevant Co., Boston, blowers; Sturtevant Engineering Co., Ltd., England, forges, fans, blowers, etc.; Thermotank Ventilating Co., Glasgow, heating system in all buildings; Vogel Co. of Canada, Ltd. (Estey Bros.), Montreal, fire sprinklers; Woven Steel Hose & Rubber Co., Trenton, N.J., armoured hose; Toch Bros., New York City.

Marsh & Henthorn, Limited, Belleville, state that large quantities of boiler tubes are needed in Canada and express their belief that there is good opportunity for the establishment of a boiler tube factory, as tubes now used are practically all imported from the United States, Germany and Belgium.

Concrete Piles for the Canadian-Vickers Plant

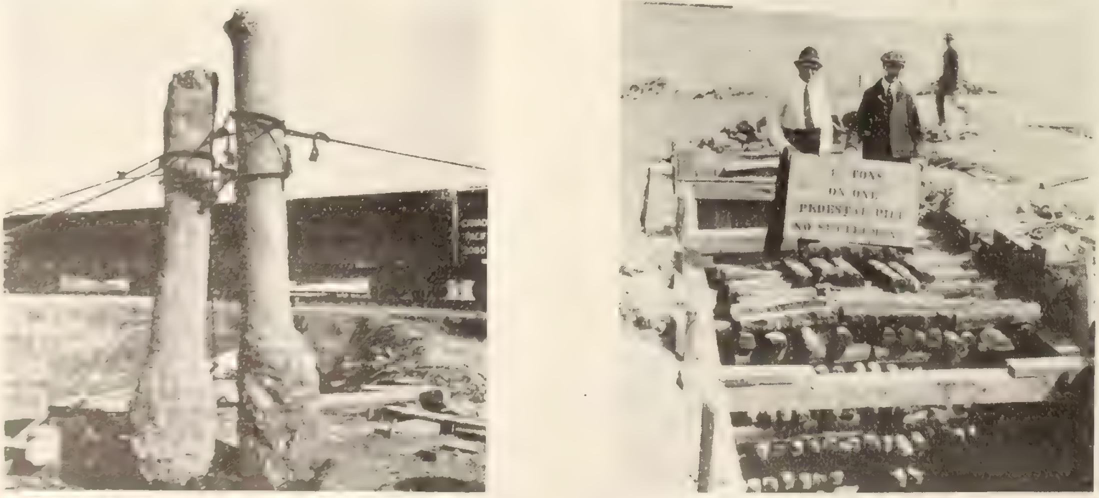
AFTER exhaustive inquiries and inspection of different types of foundations the Engineers of the Canadian-Vickers Company, aided by the experience of the general contractor, Mr. E. G. M. Cape, of Montreal, it was decided to award the various contracts, seven in all, for the foundations to the MacArthur Concrete Pile and Foundation Company, of New York, Ottawa, etc. It was judged that the enlarged base of the Pedestal Pile, the exclusive product of this company, resting on the original sea bottom would be eminently suitable for the solving of the foundation problem, while their heavy steel driving apparatus would serve the purpose of either displacing or shattering the large boulders which would inevitably be encountered. The foundation plans gave an ultimate load of thirty-two tons per mile. The various contracts awarded to the MacArthur Company were as follows:

Number of piles	Lineal feet	Buildings
66	1,991	Import stores.
747	16,857	Ship berth and retaining wall.
619	16,533	Joiners' shop, iron workers' shed, power house and electrical shop.
635	19,003	Engineer shop and boiler shop.
123	3,513	Gate house and machine foundry.
382	6,774	Central heating station and tunnel.
36	1,038	Machine foundation in boiler and machine shops.

7 contracts 2,608 piles 65,709 lineal feet.

While these contracts did not run continuously, owing to delay in reclaiming the land, the MacArthur Company were occupied for one year and seven weeks in all on this work.

The judgment of the engineers was fully justified by results. Fourteen piles were picked out at random and loaded with forty-two tons each under the



On the left concrete piles "Pedestal" type, excavated to show formation of bulb. On the right, one of fourteen tests made by the MacArthur Concrete Pile & Foundation Company.

supervision of the owners' engineers. The results of the tests were as follows:

Length of pile	Number of hours load remained on	Final settlement in feet
22 ft.	48	.006
24 ft.	48	.008
[illegible]	48	.010
[illegible]	48	.010
18 ft.	48	.006
31 ft.	48	.006
[illegible]	48	.007
20 ft.	16	.007
[illegible]	24	.004
26 ft.	24	.008
28 ft.	48	.019
27 ft.	48	.007
27 ft.	96	.001
26 ft.	96	.000

Hydrated Lime in Concrete

HYDRATED lime as an adjunct to portland-cement mortar and concrete is no new thing. Various well-known experimenters have shown that small additions of hydrated lime to cement mortars render them practically impermeable to moisture, have no material effect upon their tensile strength and much increase the plasticity of the mortar over that composed of cement and sand alone.

These very commendable characteristics of hydrated lime have been accepted by engineers without much thought as to their application to concrete work. In fact, the makers of hydrated lime, themselves, have not considered it worth while to emphasize any of them except the waterproofing feature, which is unfortunate from a selling view point, because there are many other equally effective ways of making concrete watertight. It is doubtful, however, if one engineer in twenty, accustomed to the use of concrete, has an adequate appreciation of the possibilities of hydrated lime, due to those very qualities upon which many experimenters have reported.

In two fields of concrete work there would appear to be a distinct advantage in using hydrated lime; in concrete which is to be delivered by the spouting method and in concrete roads. In the former case it has long been a cause for complaint that while spouting is a most, perhaps the most, economical and effective way of getting concrete to the forms, unless the tower is exceedingly high or the radius of deposition quite short, the low angle of slope requires an excessively wet concrete to insure easy spouting, and every experimenter knows that an excessively wet concrete is a dangerous concrete. It seems probable, however, that a proper admixture of hydrated lime would give the concrete a "buttery" consistency, a certain slipperiness, as it were, which would lower its friction coefficient and permit of its spouting on a lower slope.

The desirability of hydrated lime for concrete road work was well advocated at the recent Road Congress at Atlantic City by a lime manufacturer, Charles Warner, of Wilmington, Del. A point in favor of the use of lime in road concrete emphasized by Mr. Warner is the effect of the hydrated lime in reducing the tendency to segregation in the wet mixture of cement, sand and stone, and also in reducing the ratio of the expansion when the concrete changes from a dry condition to a wet condition. This reduced expansion is doubtless a result of the decreased permeability of the concrete made with hydrated lime. The importance of reducing segregation ought to be apparent without argument. One of the difficult things in laying a concrete road is to get the mix wet enough so that it can be readily tamped into place and will form a solid mass without voids and yet not so wet that the cement and sand will separate as the water flushes to the surface. The addition of hydrated lime materially decreases the tendency of the cement and sand to separate under the screed or the trowel, and at the same time makes the mass flow more readily into place.

It might be thought that mixing the lime with the cement, even though it did not affect the tensile strength of the mortar, might alter its hardness, since lime-mortar is much softer than cement. Since there is no place in which concrete is used where extreme hardness and resistance to concussion and abrasion are of greater importance than in a concrete road surface, the probable wear of a hydrated-lime concrete road is equally important as the ease of construction. Here is something that experience alone can answer. We are informed that at least one concrete road is this year under construction with the admixture of hydrated lime. Its behaviour will be watched with interest by engineers.

Of course, it can readily be understood that the hydrated lime must be very thoroughly mixed with the cement to secure the results above set forth. If such thorough mixing is not secured and some parts of the mortar as laid in the completed work have a deficiency of hydrated lime while others have an excess, the strength of the work might be considerably affected. The question how practically to effect such thorough mixing is not as easy as might at first sight appear. Where mortar alone is to be used and the machine mixer is available, it will be comparatively easy to put the right proportion of hydrated lime in each batch and keep the mixer turning until the lime, cement and sand are thoroughly incorporated. The great bulk of portland cement, however, is used in making concrete and the accurate proportioning of the lime to the cement and its thorough mixing with the stone and sand are matters deserving some study.

Indeed, practically all of the advantageous features set forth above have had only limited practical proof. Theoretically and experimentally there is much to be said in favor of the proper use of hydrated lime in concrete. The many engineers will look for reports on the actual construction which the next year will undoubtedly bring forth.—Engineering News.

An Important Contract on the Vickers Plant

Messrs. Dartnell, Limited, were awarded the contract for waterproofing the hydraulic press pit and foundations for Canadian Vickers, Limited, an extended description of whose plant is a feature of this issue. The work was done with a 1-in. waterproof plaster coat, with 2 per cent. "Toxement." The floor also received a 1-in. plaster coat, the operations being identical with those carried out in Messrs. Dartnell's contract for the gatehouse. It is of interest to note that in the waterproofing of the pump-house, which was carried out by Messrs. E. G. M. Cape & Company, Limited, general contractors, 2 per cent. of "Toxement" was employed. This pump-house is on the water edge of the St. Lawrence and stands a head pressure of 20 ft. The absolute water-tightness of this work is guaranteed by Messrs. Dartnell, Limited, for a period of five years.

The New Sewage Disposal Plant at Aberdeen, S.D.[*]

Details of Design, Construction, Operation and Cost, with Points of Practical Interest brought out in a Discussion of the System

PART II. (Conclusion)[†]

By W. G. Potter

All concrete was composed of Northwestern States Portland cement and pit-run Kampeska gravel, in proportions varying from 1 to 4½ to 1 to 6. This gravel was taken from below the water of Lake Kampeska, about 100 miles from Aberdeen, and is remarkably free from dirt or other foreign material. It made a very dense and solid concrete.

In construction a 35 ft. tower was erected between the main sedimentation tank and the sludge filter, and all concrete for these and for the siphon tanks was spouted from the tower to position. Gravel and cement were brought to the mixer by Koppel cars. The concrete was raised in the tower, and the gravel was drawn up an incline to a pocket above the mixer by the use of one team.

For the sprinkling filter and the final tank, the mixer was erected along the railroad spur, and all gravel was shovelled direct from the railroad car to the mixer. The concrete was run from the mixer into Koppel cars on 24-in. gauge tracks, and pushed by hand to the place of dumping. The crushed stone for the filters, of which 175 carloads were used, was unloaded mostly by rigging up a block and tackle so that a drag-scraper could be pulled lengthwise of the car, dumping at the end over a trap into a Koppel car beneath. This arrangement cut the cost of unloading and moving the stone into position by about 50 per cent. from unloading by hand.

Labor was paid 22½c. per hour at first, followed for the most of the work by 25c. per hour, and was very hard to get during the summer and fall seasons. Form carpenters were paid from 35c. to 45c. per hour and brick masons from 70c. to 80c. per hour.

The total cost of the plant will be about $130,000, of which about $20,000 will be for reconstruction of the pump house and its new machinery, $9,000 for land and right-of-way costs, about $20,000 for the force main, $17,000 for crushed stone, and the balance for concrete materials, labor, etc. The bond issue for this work was $200,000, so that there is an unexpended balance of $70,000.

Sewage was started through the new plant about April 1st, but it will still be some time before the changes in the pump station are complete.

The entire work, excepting part of the excavation, part of the pipe hauling, and the construction of the pump house building above the foundation, was done for the Commissioners of the city of Aberdeen by city forces without contract, the writer being the designing and constructing engineer, and W. D. Northen, of Chicago, the general foreman. Most of the changes of machinery in the pump station were made by Mr. W. F. Hoberton, Supt. of Water and Sewer. It is a good example of non-political municipal work, and the writer is very glad to say that politics was one of the incidental troubles that was entirely absent from this work.

Discussion

W. D. Gerber (Chairman): One of the principal points of interest in connection with this plant at Aberdeen is, I believe, the fact that it was designed by a special engineer (the author of the paper presented this evening) employed for that purpose, and constructed on a force account basis by the City. This is rather a departure from the general practice.

The Author: Changes in the pumping station are still being made, and because of the operation of the pumps the work is proceeding very slowly. It will probably be another month before the changes are completed. The cost of concrete work ran from $3.25 for the concrete floor in the sprinkling filter up to about $8.25 on part of the reinforced work. The cost of unloading stone in the sprinkling filter at first ran from 45c. to 60c. per yard. Later we were able to cut it down to 19c. to 24c. per yard by working the drag scraper lengthwise of the car and dumping through a trap into Koppel cars. Most of the cars used were gondolas. The average final cost was about 32.4c. for unloading stone from the cars and putting it in place in the filter.

Mr. Gerber: The construction of such a plant is an interesting problem, and one that usually requires special consideration. I think perhaps Mr. Sherman can give us some points on constructing concrete work of this character.

L. K. Sherman: The plant at Aberdeen furnishes two interesting features. One of them is the location of a sprinkling plant so far north, where provision had to be made for an extremely low temperature. We shall be interested to learn the future results. The other interesting feature is that to-day the people themselves are taking a higher view of necessities and requirements. We have been accustomed to thinking that sewage disposal plants were forced upon us by community growth; in other words, where the population became dense, we took care of the situation by building a plant to prevent being a nuisance to our neighbors. That we have advanced and will not put up with what we did twenty years ago in the line of sanitation is exemplified, I think, in this plant at Aberdeen. We have also become more rational in our views regarding sewage disposal. Some time ago, in speaking of sewage disposal, we said "sewage purification." Nowadays, all prominent men in sanitation work speak of it as sewage treatment. They have helped the cause of sewage disposal in not leading the layman to expect from sewage plants that which he cannot get. The efficiency of the work done at Aberdeen is worthy of especial note. I am not prepared to say whether contractors would have built the plant cheaper than Mr. Potter did. but it looks as though the work was done very reasonably. The use of the siding for unloading cars was ingenious and I have not seen this done elsewhere. The concrete tower is, of course, standard practice. In Mr. Potter's design, the sludge pipes do not extend from the valve to the surface, as is the general practice. As I understand it, the reason sludge pipes are generally run close to the top with an opening is so that a stick may be poked down, expecting that the pipe may clog. I have never heard of the use of a stick being necessary, and I do not know that the pipes do clog, but this is the first plant I have noticed in which that feature has been omitted.

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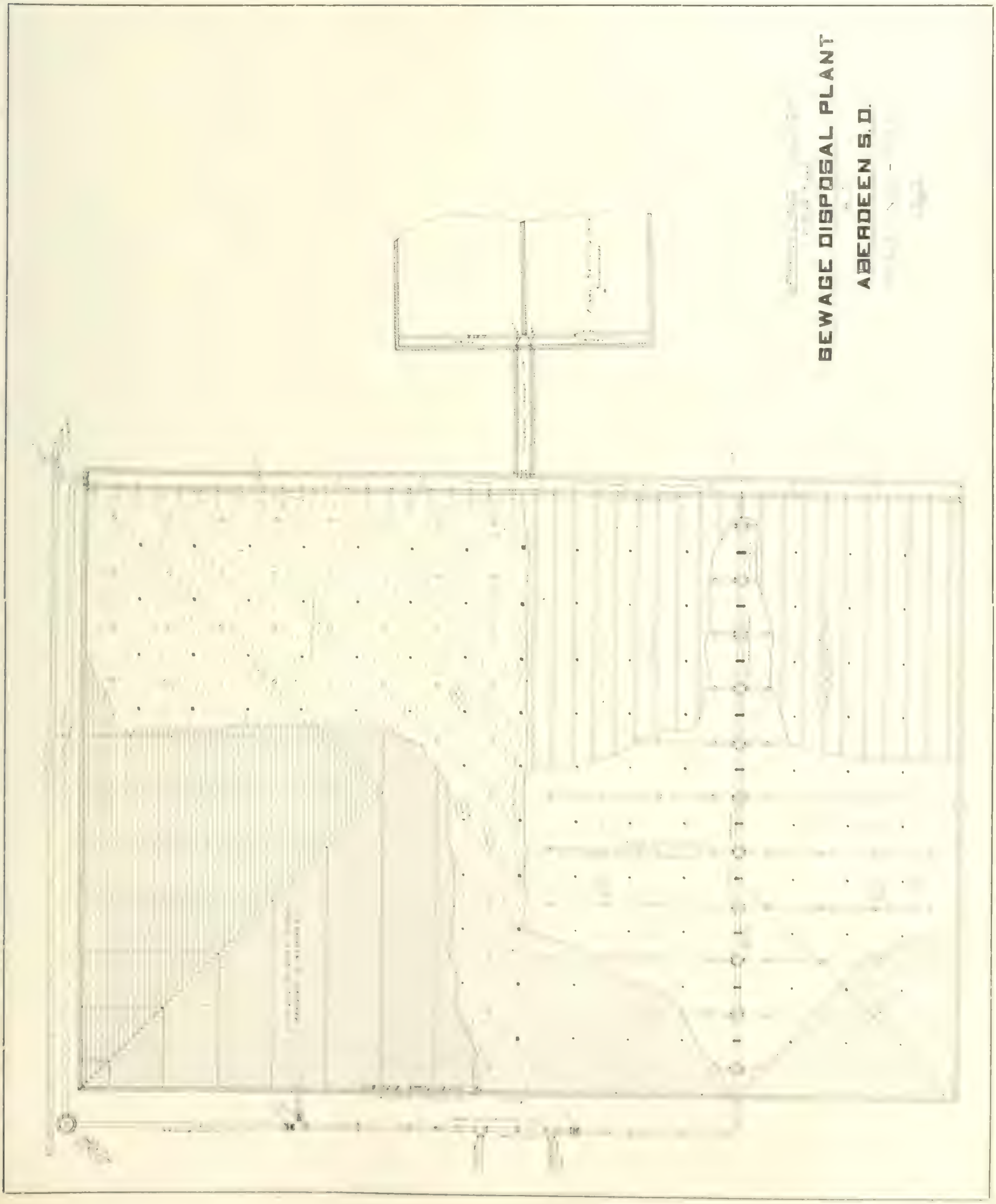
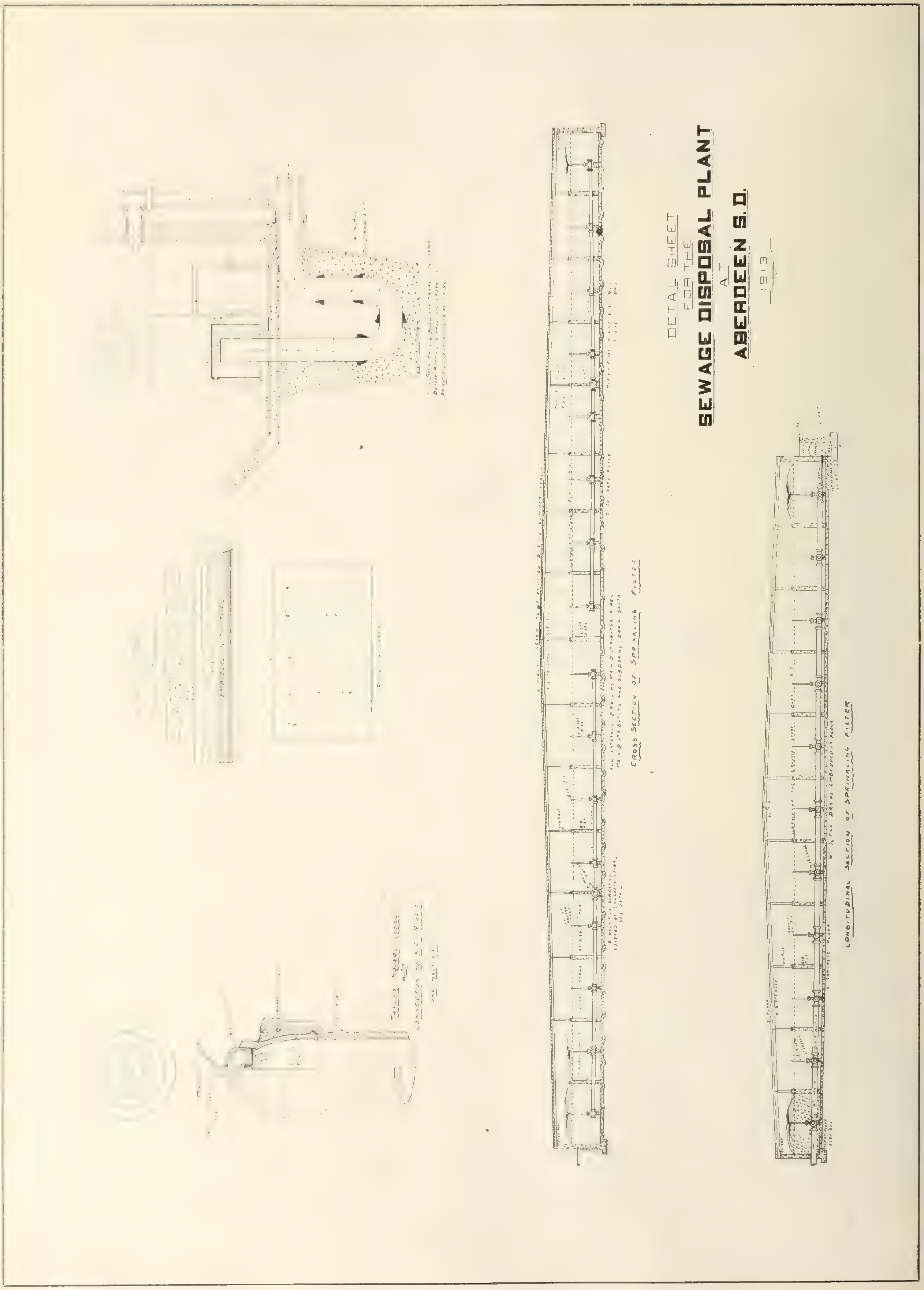
[*] Paper presented before the Hydraulic, Sanitary and Municipal Section of the Western Society of Engineers.

[†] Part I. was published in our last issue.

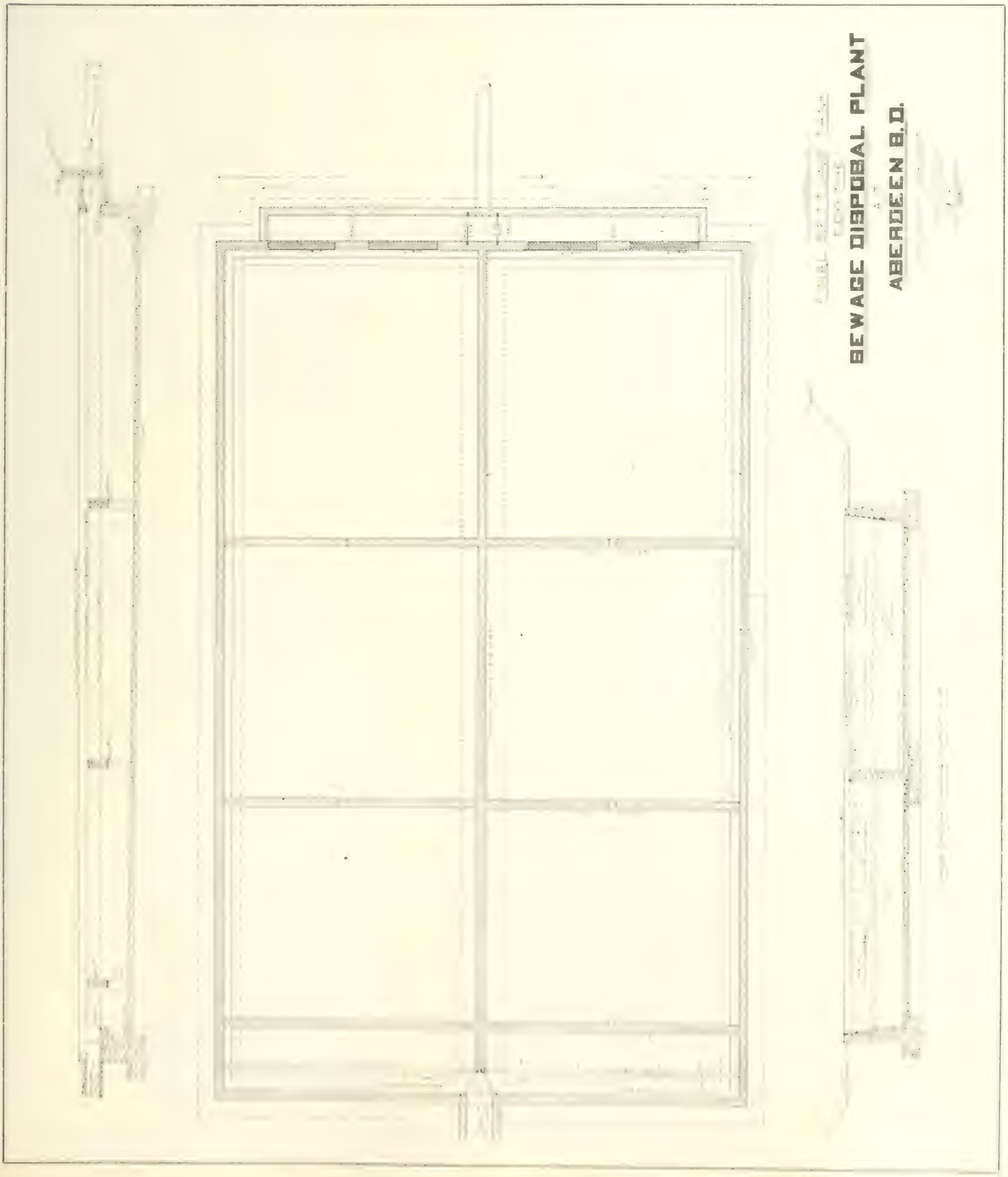
Mr. Gerber: The point Mr. Sherman brought up in regard to the design of sludge pipes is a good one. The feature doesn't cost much, and in this respect it is like a good many other precautions. A man, for instance, will carry accident insurance, and yet may never have an accident. The device may never be used, but if we want it, we want it badly.




DETAIL SHEET
FOR THE
SEWAGE DISPOSAL PLANT
AT
ABERDEEN S.D.
1913
CROSS SECTION OF SPRINKLING FILTER
ALL LATERALS DRAIN TO MAIN DISTRIBUTOR PIPES
MAIN DISTRIBUTORS AND SUBDRAINS DRAIN SOUTH
8" HALF TILE SUBDRAINS COVERED BY CONCRETE SLABS SEE DETAIL
LONGITUDINAL SECTION OF SPRINKLING FILTER
8" ½ TILE DRAINS EMBEDDED IN FLOOR
CONCRETE FLOOR

The Author: Mr. Sherman called attention to the sprinkling filter being used so far north. There are a number of sprinkling filter plants used in Saskatchewan and Alberta, but they are inclosed in buildings. In the case of the plant at Aberdeen, we have merely a temporary winter cover, which is taken off in the warmer season. They have several sprinkling filter plants of the English type, and disposal plants, in Canada, some of which have been running for the past two years, which I think have done very well. I am expecting to get considerable information from Aberdeen this coming winter in regard to that plant, and also in regard to plants in the extreme North.

Langdon Pearse: The author shows that the expenditure was about $130,000 for 12,000 people. Were 12,000 people actually connected to sewers? Also, it would be interesting if the author would give us the itemized cost, distinguishing the cost of settling basins, sprinkling filters, secondary tanks, and sludge tanks, showing the distribution of costs as compared with other plants. What I would like to know particularly, is whether, for instance, the settling plant


SEWAGE DISPOSAL PLANT
AT
ABERDEEN S.D.

[illegible], the sedimentation tank $10,000 and the sludge tank $2,000. Something in that general way would be very instructive. I have sought data available on old works in connection with our investigations for the Sanitary District and have found considerable variation of cost throughout the country. For instance, costs based on census figures do not agree with the figures covering material actually handled, per capita; the figures will run three times as high for some places as for others. I would also ask the author whether he had any difficulty in forming the sloping walls and baffles of the settling chamber in the sedimentation tank.

The Author: The sprinkling filter cost $35,000, including the rock in place. The rock amounted to 5,500 cu. yds. The rock cost was $2.96 per cu. yd. f.o.b. cars. The cost of unloading including placing was about 32c. The sedimentation tank cost $13,000. These figures are approximate only. The siphon tank cost $1,500. The sludge tank cost about $2,000. The final tank cost about $4,000. In connection with the building of the final tank we had considerable water to contend with. The pumping station, including new machinery and changing the position of the old machinery, cost $25,000. The land cost amounted to $9,000 for 80 acres, of which about three acres are in use. There was considerable general work. For instance, we had a good deal of dirt to excavate. Then there were the two dams, the by-passes, the attendant's house, and such things, that could not be included in the cost of any one of these different parts, but still were included in the total cost. The inclined walls were about 8 ins. thick, built of plain concrete. They were built by making a form for the pocket; on account of its weight, we cut the form in two, horizontally, and handled each half by means of a derrick; we put the entire form in place for each pocket, concreted the pocket, pulled the form out, and used it for the next. We had no trouble whatever in building the walls.

Mr. Sherman: I recently constructed some of these baffle walls where the situation was very much cramped, and the forms could not be taken out after they were once in place. We built them in sectional slabs, on the ground, with expanded metal. We poured mortar on the slabs and let them lie on the ground, with a part of the expanded metal protruding at the ends. When the slabs were assembled, mortar was poured over the metal which protruded, and the whole became bonded together. The method proved a successful one, and much more economical than building the walls in place and setting forms on both sides.

The Author: Form work is expensive, on sedimentation tanks especially, not only as regards cost of material, but for labor.

Mr. Gerber: There are two points brought out in this discussion on which I might give our experience. The first one is that of extending the sludge pipe above the water line. About the year 1901 we built a plain septic tank of the old flat bottom type. The man in charge was very conscientious and I was able to get from him a great many points in regard to his experience in the handling of the sludge. According to this gentleman, sludge which was allowed to stand for a period of six months or more was extremely difficult to pump on account of the compactness of the deposit. It was also his experience that it was necessary to periodically remove the scum or mat which formed on the surface of the so-called digestion chambers, for the reason that if this mat was allowed to stand and become ripe and settle to the bottom of the tank, it formed a sort of gummy mass that became almost impossible to handle even with an 8-in. centrifugal pump. He stated to me that he was able to tell purely from observation when the mat was about ripe and it was his practice to skim it off at these times. When the scum was thus prevented from settling to the bottom of the tank, it was found that the sludge proper could be very readily handled by the pump and that it did not set up so densely as when the scum was not removed. In another plant which has only been in service two years it was possible to provide sludge pipes with the discharge 5 ft. below the water line in the tank; the vertical portion of the sludge pipe was not carried above the water line. After the tank had been in service about a year an attempt was made to clean out the sludge pockets, and we found that the sludge had settled in so tightly that it did not move under the action of the 5 ft. head. It was necessary to install a pump and draw down the liquid in the tank to below the level of the discharge line of the sludge pipe. The elbow was tapped out to provide for the insertion of a 1-in. pipe nozzle. By putting water pressure on this nozzle we were able to jet the compacted sludge away from the bell mouth of the sludge pipe and get the action we desired. Since this experience, our practice has been to carry the sludge pipes above the flow line. The question of removing the forms for the casting of inclined walls in the tank proved a rather serious problem in one of our recent designs, and to obviate this difficulty we provided reinforced rectangular beams on which were placed reinforced concrete slabs 2 ins. thick. These slabs could be placed from above and when so placed were grouted in with cement mortar. About the only difference between our construction and that referred to by Mr. Sherman is that each was separate and the reinforcing was not allowed to extend beyond each individual slab.

W. W. DeBerard: It may be of interest to know that in California they have recently changed two septic tanks at Orange into shallow Imhoff tanks. This was done with the idea that it would be an experiment, so redwood was used for the baffles and flowing-through troughs. If successful, they are to be reconstructed in a more substantial manner. The tanks were 70 ft . long, 10 ft. wide, and 7 ft. sewage depth, and were entirely covered over with a concrete roof. There was no means of getting into these tanks, and five holes had to be cut through the top of each tank. So as to make the hanging baffle walls remove the sludge and to keep the sludge from running lengthwise, tight cross partitions were constructed every 14 ft. On the bottom of the floor was laid a sort of underdrain system of vitrified pipe with thirty holes. It drained into a single pipe line and each compartment was controlled by a valve. Prof. Charles Gilman Hyde, consulting engineer on this work, wrote me in August stating that he found the plant at that time working fairly well after eight or nine months' service. There was some odor of hydrogen sulphide which he attributed to the fact that the basins had not been cleaned of scum as often as desirable. The city water contains such a high percentage of sulphates, elimination of the gas is practically impossible if any septic action takes place. The sludge is raised from the sludge pit by means of a centrifugal pump. Notwithstanding the action of the pump upon the sludge, which would tend to liberate the gas therefrom, it seemed to dry readily and to be fairly porous and typical of sludges from deeper Imhoff tanks.

The Author: It is a question whether the condition of the tank at Aberdeen was not in a measure due to

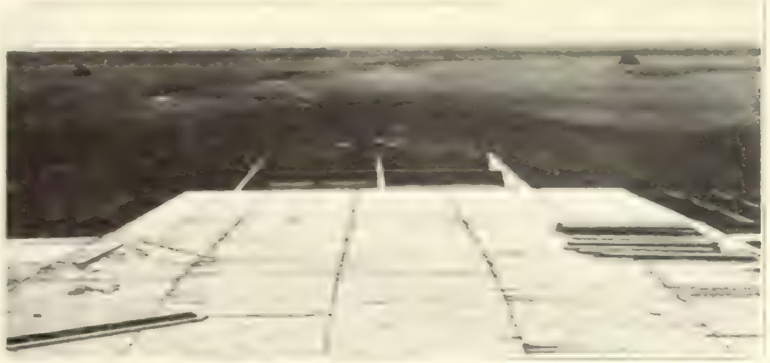


Fig. [illegible]—Sprinkling filter partly [illegible] over

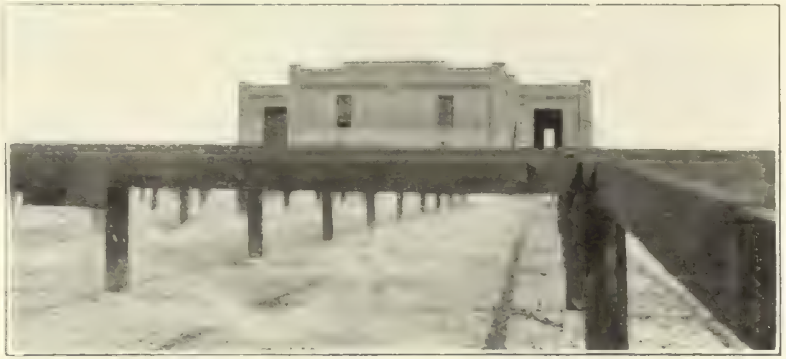


Fig. 11.—Sprinkling filter in operation. Sedimentation tank in background.

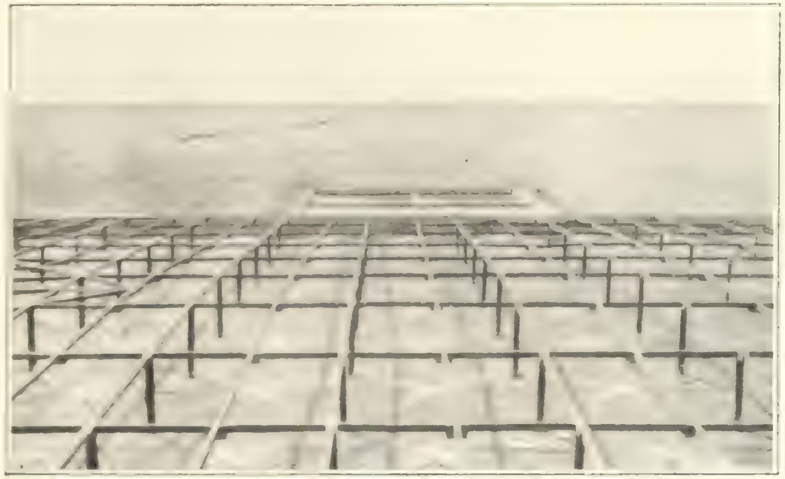


Fig. [illegible]—[illegible] filter in [illegible]. Final settling tank and outlet flume in background

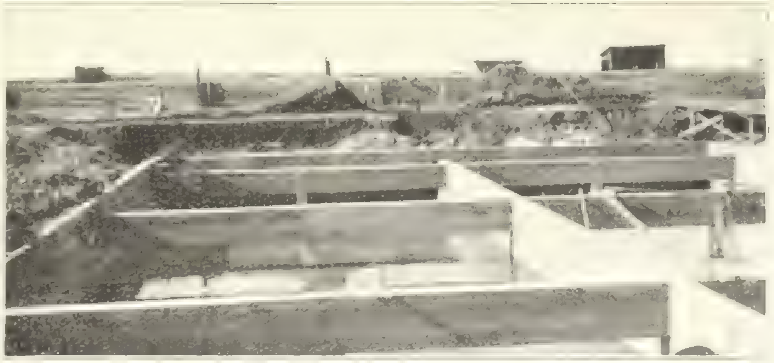


Fig. 13. General view of final settling tank

The New Sewage Disposal Plant at Aberdeen, S. D.

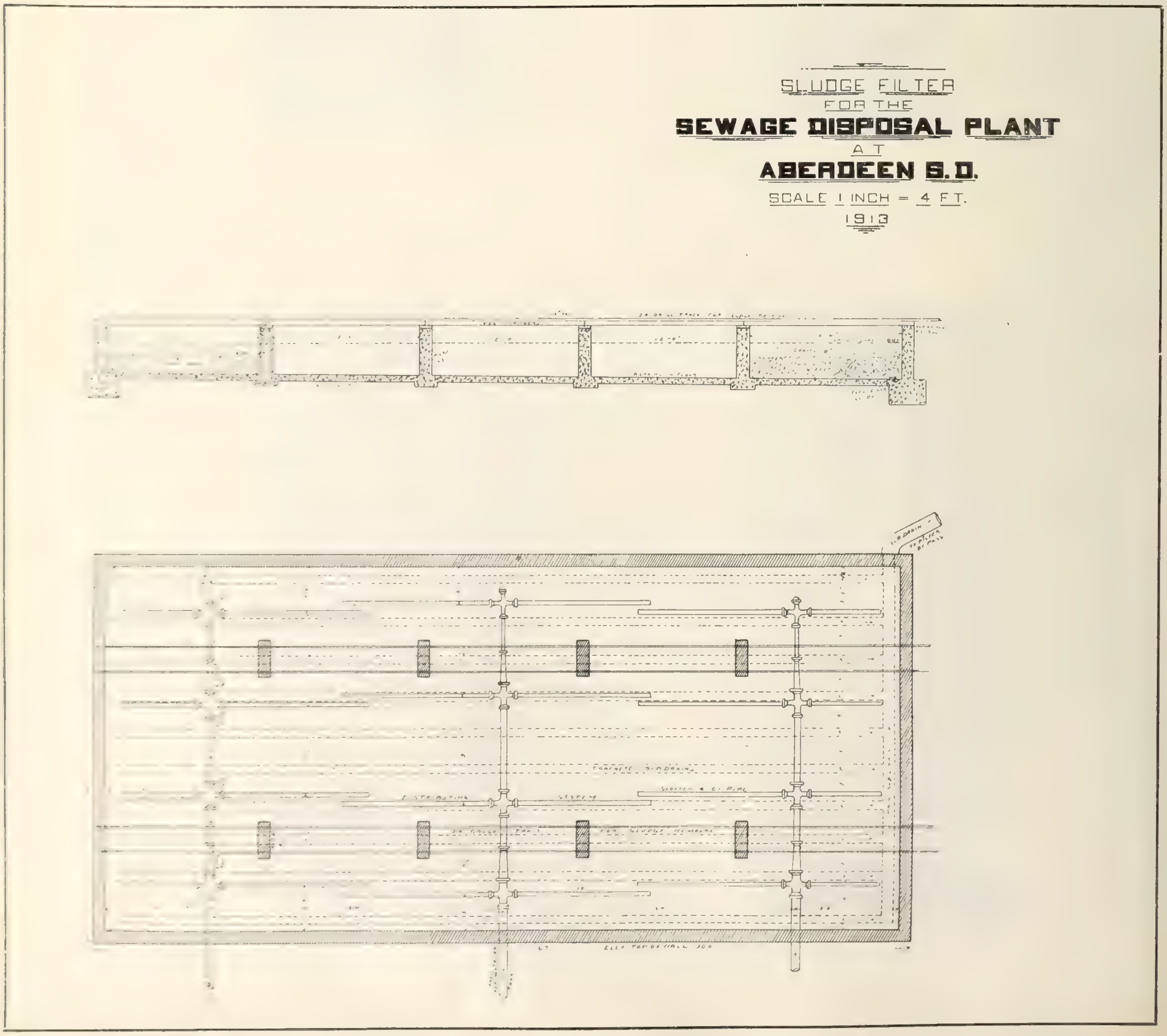
the class of material used in the concrete. The local sand used in this work has a great deal of shale in it. I think that, possibly, was the cause of disintegration.

Mr. DeBerard: The reason for changing the type of tank in the California plant was not because it was not used for city sewage, but because it was used for city sewage, and made more or less of an odor. The water supply of the town was full of sulphates, equivalent to from 150 to 500 pounds per million gallons.

A. T. Maltby: While listening to the reading of this paper there were two things that impressed me. One was that the power provided at the pumping station consists of one 55 h.p. and one 110 h.p. engine, or a total of 165 h.p. The plant, as I understand it, was designed to handle 1½ million gallons per day and the difference in elevation is 25 ft. As the theoretical requirements are only about 6½ h.p. for 26 ft. elevation it would seem that you are providing for a considerable excess of power. My next point is in regard to the depth of the tank; I infer from the reading that it is 17 ft. The general practice in this type of tank seems to be about 30 ft. It is claimed that with this greater depth a better grade of sludge is produced. In other words, a sludge that is better digested and that will dry out to better advantage. There has been considerable discussion on this subject and it would be of interest if the author would keep in touch with the operation and results obtained from this tank. If the shallow type of tank will produce an acceptable character of sludge, it will be a good thing to know, as it would cheapen the cost materially.

The Author: In regard to the power. We have a 26 ft. lift besides the friction from the two-mile force main. And then, too, the larger size engine was put in with a view to some day using that power also for another purpose for the city—running some of the boulevard lights. I think the depth of tanks in Germany is 30 to 40 ft., but there are a number of plants in this country in which the tanks are not so deep. It will be interesting to watch the Aberdeen plant for the coming year or two years, to see what is the effect.

Water for irrigating cannot be judged solely by the taste, states Dr. A. E. Vinson, of the University of Arizona Agricultural Experiment Station, since an injurious amount of black alkali does not reveal itself in this way. For drinking purposes such waters are not harmful. The importance of the quality of irrigating waters is being emphasized by Dr. Vinson.



Investigation of the Discharge of Inflammable Wastes into Sewers

IT is thought that some of the more recent and more violent explosions in sewers were caused by the presence of gasoline vapor. If this belief is well founded it follows that the advent of motor-driven vehicles has created a problem in sewer design and maintenance which may prove difficult and expensive to solve. Sewer systems are generally looked upon by the average person as a quick and easy means of disposing of any or all waste matter which can be carried away by the sewer, without any consideration whatsoever of the effect of such discharge, either upon the structure itself, or upon its maintenance and operation. The transition in the mode of travel from horse-driven vehicles to the motor-driven car and auto-truck renders the transportation, handling and use of large quantities of gasoline necessary and it is inevitable that in the handling of this material some will be spilled or wasted either by accident or design, which will find its way into the sewers. The solution of this problem is now occupying the attention of sewerage engineers. The present article (abstracted by Engineering & Contracting) is from a paper by Mr. N. S. Sprague, Superintendent of the Pittsburgh Department of Public Works, before the recent annual convention of the American Society of Municipal Improvements. It discusses the discharge of inflammable wastes into sewerage systems and the problem of prevention. The scope of the sewer explosion investigation now being conducted in Pittsburgh is also described.

There are many sources which contribute inflammable wastes in a greater or less degree, ranging from the small and irregular discharges from households and private garages, which may amount to considerable in the aggregate, to the large and intermittent discharges from manufacturing and storage plants and other enterprises which use large quantities of gasoline.

In some cities (Pittsburgh included) the laws relating to the storage of gasoline require the tanks to be buried in the ground. These tanks, which are made of riveted steel plates, vary in capacity from about 50 to 15,000 gals. The purpose of placing them underground is to prevent possible ignition of the gas and protect them in case of a nearby fire. It is not the author's intention to discuss the advisability or the objection to placing gasoline storage tanks underground, but simply to point out the possible danger of gasoline escaping from these tanks and entering the sewers. The thickness of the steel plates of which the tanks are made, is generally from 1/8 to 3/16 in. and their only protection from corrosion is the application of ordinary structural paint. The tanks are laid directly upon the ground and then covered with earth. Under such conditions, corrosion is rapid. It is also possible, under favorable conditions, that the tanks may suffer injury due to electrolytic action. In any case, there is no opportunity for inspection or repairs and leaks can only be detected by making a comparison of the quantity of gasoline put into the tank and the quantity removed. This information is in the possession of the owners and in case a leak is disclosed by a comparison of the figures, the owners are not likely to volunteer the information to the public authorities.

The possibility of gasoline escaping from the tanks into the ground and finding its way into the sewers may be remote, but with pervious soil or a nearby catch basin or trap, the opportunity for leakage into the sewers is at least present. In certain locations it is quite possible to set these tanks above ground, where ample opportunity for inspection and repairs would be possible. The waste gasoline from households, private garages and shops is so well distributed throughout the lateral sewer system and the average amount discharged at any one time so small that it is quickly dissipated before the formation of explosive vapors can occur. It is therefore to be supposed that the formation of gasoline vapor and other explosive gases present in sewers originates from establishments which are large users or dealers in inflammable materials.

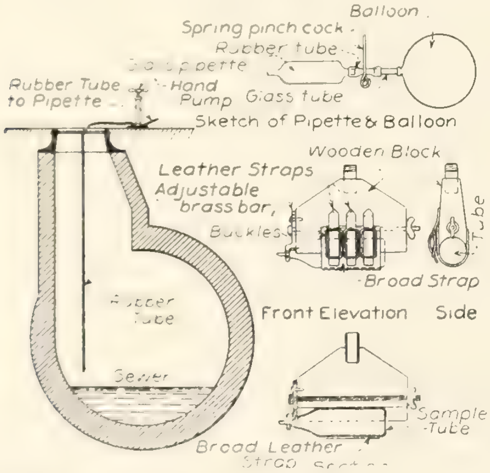
There being in most cases no laws prohibiting the discharge of inflammable wastes into sewers and the danger of such practice not being generally understood, the natural disposition of such wastes is into the sewers. These wastes comprise dirty and used gasoline, benzine, oil, washings from tanks, and refuse from gas plants, paint works, etc. The quantity of these waste products varies according to the magnitude of business and methods employed.

While the discharge of gasoline into the public sewers probably exceeds in quantity any other inflammable waste, yet the discharge of waste products from paint works, oil refineries, gas works, etc., is likely to produce conditions which, under favorable circumstances, may fill the sewer with explosive gas. Ignition of explosive gases, when present in the sewers, may occur in many different ways—for instance: sparks from street railway tracks, hot cinders and sparks from locomotives, stacks, etc., which may enter the manholes through the perforations in the covers, or when same are removed for inspection or repairs; also the dropping of matches or lighted cigars into manholes or catch basins; lights and sparks from tools, while making inspection or repairs within the sewer or at chambers, pumping stations or disposal plants.

The problem of preventing sewer explosions would then seem to be a question of either effectually sealing all openings into sewers or excluding or regulating the discharge of inflammable or explosive wastes.

A number of cities have attempted to solve the problem by procuring legislation prohibiting or regulating the discharge of inflammable waste materials into the sewers. Prior to the general use of motor vehicles there were many industrial and business establishments using inflammable and volatile wastes, such as dry cleaning establishments, paint manufactories, gas works, etc. Notwithstanding the fact, explosions in sewers caused by the ignition of gasoline vapor were uncommon. This fact would seem to indicate that the greatly increased use of gasoline due to the growth of the automobile industry has been responsible for many of the recent sewer explosions.

Accepting this theory as a working basis, we must determine whether or not the gasoline is discharging into the sewers in large quantities by a relatively few people or in small quantities by a great number. In the first case the situation is relatively easy to control, while in the latter, it would be difficult. Moreover, it is necessary and important to determine whether the explosive vapor is generated from the accumulative effect of a great number of small discharges or from the discharge of large doses. Past experience has shown that the ordinary means of providing ventilation in sewerage systems has been generally adequate to prevent the collection of explosive gases. If large doses of inflammable wastes are allowed to enter the sewers, other means of ventilation will have to be provided or the sewers sealed. The installation of mechanical ventilation in sewers throughout the system would remove the gases, but would involve great initial outlay and the cost of maintenance and operation would generally be prohibitive. This scheme would not seem practicable. There is no practical way of providing sufficient ventilation either by mechanical or natural means which would exhaust the air inside the sewer quickly enough to prevent the formation of an explosive compound in case large quantities of gasoline were present in the sewer. With the exclusion of large discharges of gasoline into the sewers, the danger of explosions can be greatly lessened by giving more attention to the improvement of the natural ventilation. This would probably be sufficient to prevent the collection of explosive vapors arising from the normal amount of gasoline discharged into the sewers. To form an explosive mixture a certain amount of air and gas is required. If there is a shortage of gas or an excess of air, no explosion can occur.



Details of apparatus for taking samples of air inside of sewer.

It cannot be ignored that many sewer explosions have resulted from the leakage of natural or artificial gas into the sewers. Evidence has been conclusive in a sufficient number of cases to show unmistakably that this is a fact. The prevention of explosions from this source, however, is well within the jurisdiction of public officials and the remedy is the right construction of sewers and proper laying and location of gas pipes. The remedy in this case consists, therefore, in enforcement of powers that municipalities at present possess.

Modern sewer design provides for the ventilation and inspection of the structure. The discharge of inflammable wastes into sewer systems would not of itself be a serious matter, or objectionable, were it not for the possibilities of igniting the explosive compounds. Ignition of gases in the sewers could be prevented by sealing all openings, but this would prevent inspection and create impossible working conditions inside the sewer when repairs became necessary. Moreover, the sealing of the sewers would not prevent ignition at chambers, pumping stations and disposal plants. In addition to the foregoing, there are other reasons which would make the sealing of the sewers impracticable and inadvisable.

The exclusion of inflammable wastes from a sewer system brings up the question of how it shall be accomplished. The regulation of the Municipal Explosives Commission of the City of New York, adopted January 3, 1912, require the installation of oil separator traps or similar apparatus. The city of Boston requires a special trap which will prevent the discharge of the objectionable wastes into the sewers, and the city of Chicago has somewhat similar regulations to those of New York, governing the matter.

The efficiency of these devices is dependent upon the attention paid to their operation by the individual. Careless operation or neglect might render them of little value and defeat the purpose for which they were installed. Therefore, frequent inspection should be made by the proper public officers. Their general use on all sewer connections where gasoline or other inflammable waste is discharged would seem prohibitive, if found advisable, on account of the cost. The compulsory installation of devices for removing oil will generally meet with opposition by those affected, which has been recently demonstrated by the passage of an ordinance in New York City repealing the ordinance requiring the installation of oil separators. I am informed that this repealing ordinance was vetoed by the Mayor.

Formulation of legislation directed toward the prohibition of the discharge of inflammable wastes into sewers is at present receiving attention in many cities. That the same may be effectual requires the most careful consideration. It is most desirable that the necessity for such regulations be demonstrated and the efficiency of any device thoroughly proved before they are required by ordinance.

The writer has examined the regulations of a number of cities, and has come to the conclusion that it would be best from the standpoint of enforcement, to have all regulations of this nature contained in a single ordinance which would cover all phases of the discharge of wastes of all descriptions into the sewers. Such an ordinance should contain the following:

(a) Prohibition against the discharge of any inflammable gas, volatile inflammable liquid, inflammable liquid, oil or gas, or any calcium carbide or residue therefrom, or any liquid or other material or substance containing inflammable gas or which would evolve an inflammable gas when in contact with water or sewage.

(b) Regulations as to how sewer connections with establishments from which the foregoing wastes emanate may be made. This may or may not require the installation of special traps, separators or similar devices.

(c) Provision for the examination and approval of all intercepting devices and provision for their inspection, maintenance and operation.

(d) Provision with regard to the discharge or placing of obstructing material in any part of the sewer system.

(e) Regulations as to the discharge of steam or hot liquid or gaseous waste into the sewers.

(f) Regulating the location of gas pipes in city streets with reference to the sewer; prohibiting the placing of gas pipes close to or within the masonry of sewers.

(g) Prohibiting connection from manholes, gate boxes, or other apparatus of public service corporations to the sewers, except in an approved manner and when properly trapped.

Legislation alone will not secure or prevent the discharge of these objectionable wastes into sewer systems, but by informing the people of the damage resulting from this practice, the offence will be greatly lessened.

It would appear desirable, in the interest of public safety, where oil separators or similar devices are installed, for the municipality to undertake the final disposition of the residue rather than entrust it to the individual. The importance of the problem of regulating the discharge of inflammable waste, etc., and the necessity for its strict and effectual regulation has been amply and forcefully demonstrated by recent violent and destructive explosions.

As recently as September 22, 1914, another serious explosion occurred in the sewer on East 42nd Street, between Third Avenue and East River, New York, making the third explosion in the same sewer within a year. Reports state that the physical damage to the sewer, buildings and street, was not extensive. This is accounted for by the fact that the sewer was a brick-lined tunnel in rock about 40 ft. below the street surface. Under less favorable conditions of location and design this result would have been far more serious.

The most disastrous and expensive sewer explosion up to the present time, although entailing no loss of life, occurred at Pittsburgh on November 25, 1913. This explosion to date has cost the city about $300,000, which may be increased by possible damage suits.

This problem is not confined to the prevention of explosions in the sewers themselves, but may extend to all kinds of sewerage works as shown by the explosion in the screen chamber at East Boston, which occurred June 1st of this year. In this explosion, which was caused by the presence of gasoline vapor, six lives were lost and three men severely injured.

Without mention of other recent sewer explosions, it is evident from experience covering many cities, that an immediate, effectual and permanent remedy must be found to control the situation. With three explosions in the 42nd Street sewer in New York and two in the 33rd Street sewer in Pittsburgh, all within less than a year of each other, there can be no question but what the conditions inside of all large sewers draining garages, etc., are such as to produce explosions whenever ignition occurs. The safety of the public and the welfare of the community are therefore now dependent more upon good fortune than the certainty of scientific control, hence the public is always exposed to the hidden danger which only requires a chance spark to cause havoc and disaster.

The present situation can be likened to the man sitting on a keg of powder.

Sewer Explosion Investigation at Pittsburgh

The city of Pittsburgh, immediately after the second explosion, set about to make an investigation and study with a view of preventing a repetition of such disasters. This investigation is being conducted jointly by the city and the local office of the U. S. Bureau of Mines, who have rendered valuable assistance and advice.

The purpose of this investigation, which is still in progress, follows: (1) To locate all possible sources from which gasoline or other explosive wastes might enter the sewers. (2) To determine by a series of examinations and tests the location of the sources where the waste was discharged. (3) The determination of the presence, extent and quantity of vapor within the sewers. (4) Experiments to determine the effect and behaviour of gasoline dumped into the sewer in different quantities and at different intervals.

The 33rd Street drainage basin was selected for study because of the number of garages within the basin and the fact that two explosions have already occurred, indicating the discharge of large quantities of explosive waste into the sewer. The 33rd Street drainage basin has an area of 1,642 acres, a population of 53,785, and a total of 417 structures where inflammable and explosive materials are handled. These structures are classified as follows: 295 small garages, not more than two cars, includes private and small business garages; 67 large garages, not less than three cars, includes public garages, repair shops, large business garages, etc.; 12 gasoline storage establishments; 1 dry cleaning establishment; 2 paint shops; 39 business or manufacturing places where inflammable oil or gases are manufactured, used, sold, handled or washed; includes gasoline supply establishments, large automobile establishments where gasoline is stored, sold and used in large quantities.

A map was prepared showing the outline of the basin, the sewer system within and the location of all garages, dry cleaning establishments and other places where inflammable or explosive wastes are likely to be discharged into the sewers. The map will be used in connection with studies to locate the point or points where the discharge of inflammable wastes occur.

Letters of inquiry were sent to all the principal cities in the country with a view of obtaining data and information relative to sewer explosions and what laws or ordinances were in force regulating or controlling the discharge of inflammable or explosive wastes into the sewerage systems. The answers received in reply to those inquiries were compiled and have been printed in pamphlet form and copies furnished to each city supplying information.

Apparatus was designed for securing samples of air within the sewer and for making field tests of same. The apparatus used is shown in the accompanying cut.

The results so far secured in the investigation indicate the presence of gasoline vapor in the sewers of both the 33rd Street and Negley Run systems. This latter system drains an area of about 2,500 acres with a population of about 50,000 and there are considerably less sources from which inflammable wastes are discharged than in the 33rd Street system. Analyses of a series of samples taken on the same day at various points in these systems have shown that gasoline vapor in small amounts is present throughout the sewer system. The gasoline vapor ranges from 0.012 to 0.065 per cent. of the volume of sewer air in the sample. While these percentages of gasoline vapor are considerably below the danger mark, which may be taken as 2 per cent., it goes to show that the natural ventilation of these sewer systems is not sufficient to remove the effects of the ordinary or normal discharge of gasoline.

The Negley Run system drains through duplicate outlet sewers for a distance of over a mile, during which distance there are no connections known which could by any possibility discharge gasoline. Above this point, there are a number of large branch sewers of considerable length so that taking these larger sewers of the system together with the many miles of laterals, with the opportunity for ventilation provided, it must follow that natural ventilation would not suf-

[illegible] to remove the effects of the discharge of gasoline in large doses.

It is expected that these experiments will require considerable time before definite conclusions can be reached and preventive measures, based upon them, can be formulated, but it is hoped that some plan or action can be devised which, without imposing hardship or undue expense upon the people, will secure to them freedom from the peril and danger to which they are now constantly exposed.

Road Construction Plant and the Contractor

UPON undertaking road construction it is required to be determined what type of construction plant is best suited to the work in hand, how much plant is required to complete the work with the greatest economy and profit, and what additional plant is required to expedite construction so that time limitations will not be exceeded.

Every construction project has certain fixed limitations within which the contractor must keep in planning work to be accomplished. These limits may be due to varied and uncontrollable causes, such as the type and number of laborers available, the location of the project with reference to bases of supplies, the length of profitable working season, topographic conditions with reference to ease of hauling and as affecting the installation and use of plant, climatic conditions during the working season—a most important factor—and facilities for quickly and profitably disposing of or storing plant after the completion of the work. Moreover, on contract work specifications invariably define other limits, such as the time of completion, the type and quality of material to be used, involving possible delay in securing materials at the proper time and consequent disorganization and loss to the contractor, and the possibility of important changes in the plan and extent of the work while in progress.

The foregoing are the broad general conditions confronting the contractor upon undertaking road construction work. In attacking this equipment problem the three important questions to answer are: What plant is best suited to the work, how shall it be acquired, and what will be its value after the completion of the work? In answering these questions sound experience is undoubtedly of greatest value in the proper correlation and nice weighing of the conditions affecting the proposed work.

There are, however, a few general rules of thumb in vogue among contractors that are worthy of mention. Plant is a substitute for labor, and its use is economical only when it will yield a good return on the investment over and above the labor cost without the use of plant. The economic ratio between plant and labor is, in a measure, a fixed quantity for each construction project. Whether or not any plant at all is needed and what is the least amount with which the work may be accomplished are fundamental questions. Finally, second-hand plant is to be avoided if the contractor expects to continue in the same line of contracting; if he expects to undertake a different type of work on the next project it may be a profitable investment.

Many contractors do not figure on plant expense when bidding on work. The first job undertaken is frequently figured with no profit other than the plant purchased. On succeeding jobs plant cost is not included, unless new plant is required. In short, the job pays for the plant. In figuring on the disposal of the plant at the conclusion of the work, as a rule, heavy machinery if sold will not bring to exceed 25 per cent. of the first cost. Light machinery and small tools are usually worn out on the job and at its termination must be disposed of as scrap. Second-hand machinery ordinarily sells at about 50 per cent. of its first cost after overhauling by machinery dealers. The salvage value of second-hand machinery but slightly used is larger than that of slightly used new machinery. In other words, the ratio of the value of third-hand to second-hand machinery is greater than second-hand to first-hand machinery.

Construction plant is the great problem of the road contractor. The cost of plant used frequently exceeds 33 per cent. of the total cost of the work accomplished and seldom falls below 20 per cent. Unless plant is keenly judged, shrewdly acquired and kept constantly at work the profits of the road contractor may be continually feeding the mill in the merry-go-round of machinery purchasing.—Engineering and Contracting.

A Song of Six Per Cent.

An inside, professional view of the architect's scale of remuneration is contained in the following humourous verses, recited at a recent meeting of the Cleveland Chapter of the American Institute of Architects:

"Sing a song of six per cent.
Pockets full of dough,
That's what the client thinks
Because he doesn't know.
Poor darned architect
Knows he's just a slob;
Six per cent. is not so much
Unless you've got a job.

Sing a song of six per cent.
Arc'tec full of rye;
Million-dollar c'mmissions
Float before his eye;
When the night is over,
How his head does ache!
A yiddish flat at two per cent.
Is what he'll gladly take."

The policy of the British Columbia Government reflects the greatest optimism and confidence. Public works are proceeding, new construction is being opened up in various sections by the railways, and every effort is being made generally to maintain the stability of the business situation.

Good roads prevent disease, according to the State Board of Health of Kansas. The removal of weeds and trash, which prevent the evaporation of moisture and promote the retention of ground water, deprives mosquitoes, flies and other disease carriers of their breeding spots. Good roads also prevent disease by providing good drainage.

The unit method of reinforced concrete construction has an advantage over monolithic construction in the speed with which buildings can be erected. This is often a very valuable consideration where replacements are being made, or where the work is needed in a great rush.

Personal Mention

Mr. R. L. Werry has resigned the Secretaryship of the Montreal Builders' Exchange.

Mr. L. A. St. Marie is the new Town Engineer of Longueuil, P.Q., succeeding Mr. Prefontaine.

Mr. Chas. Johnston has been appointed Assistant Engineer to Mr. H. S. Van Scoyoc, Chief Engineer of the new highway between Toronto and Hamilton.

Mr. Arthur Surveyer read a paper "Making our Water Powers Valuable" at a recent meeting of the Electrical Section of the Canadian Society of Civil Engineers in Montreal.

Mr. W. E. Bradshaw lectured recently before the Engineering Society of the University of New Brunswick on the design and construction of the new bridge over the Reversible Falls at St. John.

Mr. F. S. Mallory, architect, has taken over the offices at 65 Adelaide Street East, Toronto, of the late Mr. F. H. Herbert, with whom he had been associated in practice for a number of years.

Mr. Wm. Pearce gave an interesting address at a recent meeting of the Calgary Branch of the Canadian Society of Civil Engineers. The subject of Mr. Pearce's observations was "Irrigation in Egypt."

Mr. J. M. Wilson has been appointed to succeed Mr. J. G. Sing as resident engineer in Toronto for the Department of Public Works. Mr. Wilson was formerly assistant resident engineer in that Department.

Mr. Geo. Janin, City Engineer of Montreal, who recently organized a corps of engineers for active service, has obtained a commission and will go into training with the men. Mr. Janin is 61 years old, but he is eager to go to the front.

Mr. James L. Brusse, a young civil engineer of Vancouver, B.C., was killed recently on a huntng trip in British Columbia. He was 28 years old, a native of Denver, Colo., and a graduate in civil engineering of the University of Denver.

Mr. Kenichi Nakamaura, a civil engineer on the staff of the Imperial Government Railways of Japan, and Mr. H. Sugi, of the engineering department of the railways, are in Canada for the purpose of studying the railways of the Dominion.

Mr. Geo. J. Bury has been appointed Vice-President of the C. P. R. in succession to Mr. David McNicoll, whose resignation owing to ill-health was announced recently. Mr. Bury is a native of Montreal and joined the C. P. R. as a clerk in 1883.

Mr. George W. Hunt, formerly President and General Manager of the Canadian Asphalt Company, Limited, has been appointed Sales Manager for Mr. John Baker, Jr., dealer in asphalt, bituminous products and road oils, [illegible] South La Salle Street, Chicago.

Mr. James Geddes, assistant to the general manager of the Louisville & Nashville R. R., at Nashville, Tenn., died recently. He was born, [illegible], Scotland. From 1846 to 1850 he was with the civil engineering department of the Great Western Railway, England. On coming to America he was for eight years, [illegible], a location and construction engineer of the Louisville& Nashville R. R. He then entered the operating department and for many years was superintendent of the Nashville division. Since [illegible] he has been assistant to the general manager.

The Eleventh Annual Convention of the Sand-Lime Brick Association is to be held at the Algonquin Hotel, Dayton, Ohio, December 8-9 next. The President of the association is Mr. S. O. Goho, Harrisburg, Pa., and the Secretary is Mr. W. E. Plummer, Jr., Buffalo, N.Y. It is of interest to note that a paper, entitled, "Sand-Lime Brick in Europe," is to be read on the second day of the meeting by Mr. Harold D. Robertson, of Toronto.

Regina Engineering Society

At the annual meeting of the above Society, held recently, Mr. L. A. Thornton (Works Commissioner) was elected President and Mr. J. M. Mackay (Superintendent of Waterworks) Secretary for the year 1914-15.

About thirty members took part in a visit to Moose Jaw where the City Engineer, Mr. Geo. D. Mackie, had made elaborate arrangements, including a special street car and a fleet of automobiles, for showing the party around the various works of engineering interest in the city. Among those visited were the Power station (where a demonstration of the recently installed high pressure water system [illegible]) the sewage disposal plants, the new Dominion Government internal storage elevator, and the Robin Hood flour mills.

Mr. L. A. Thornton, the newly-elected President Regina Engineering Society

The Society's annual dinner was held in the King's Hotel, Regina, early last month. The guests included His Honour Lieut-Governor Brown, Chief Justice Haultain, Mr. Wm. M. Martin, M.P.; Mr. J. F. Bole, M.L.A.; Mr. Robt. Martin, Mayor of Regina; and Mr. Jas. Pascoe, Mayor of Moose Jaw.

A meeting of the Society was held in Regina College on Thursday, December 3rd, when the President delivered his inaugural address.

The annual general meeting of the Province of Quebec Association of Architects will be held in the Association rooms, 4 Beaver Hall Square, Montreal, on January [illegible], 1915, at [illegible] p.m. The examination for admission to the study of architecture or registration in the Province will be held on January [illegible], 1915, and on the following days, in the rooms of the P. Q. A. A., at nine o'clock each day

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Rapid Earthwork Calculation. By C. E. Housden. Longmans, Green & Company, New York City. 31 pages, with diagrams and tables. Price [illegible]. An interesting little work embodying improvements in earthwork calculation suggested by a careful reconsideration of the author's "Practical Earthwork Tables." These tables as well as their application are considerably simplified yet left sufficiently full to ensure of correct results being arrived at under all the conditions likely to be met with in actual practice.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

At Levis, Que., the Intercolonial Railway has decided to build a new station to replace the structure recently burned down.

The ratepayers of Guelph, Ont., will be asked next January to vote on a proposal to spend $125,000 for a new Collegiate Institute.

The Toronto city council has decided not to submit a by-law next January in connection with the proposal to raise an additional $167,000 for the Gerrard Street Bridge project.

St. Catharines city council have in contemplation a scheme for strengthening the bridge across the Welland Canal in order to provide for heavy through cars on radial lines.

At Hamilton, operations have commenced on sewer work estimated to cost $130,000. Tenders for new pump-house and pumps will not be called until next summer. The City Engineer is Mr. A. F. Macallum.

The government is considering an application for $270,000 from the County Council of Halton, Ont. The money is to be utilized along with a similar sum already raised by the county for building 160 miles of good roads.

The city of Sarnia, Ont., has raised $112,814 to be expended on the purchase of the Port Huron Thresher Works, which plant is on the site required by the Grand Trunk Railway for the location of their car shops at S. Port Huron.

At Felicien, Que., work is progressing on the construction of a new church for the Parish of St. Felicien, 212 x 75 feet, stone construction, the estimated cost of which is $125,000. Mr. Joseph Bouellet is the architect, the general contractor being Mr. E. Trembley.

Mr. J. S. Ferguson, of the Northern Development branch of the Ontario Service, died suddenly at North Bay, Ont., recently. He was 50 years of age and for the past three years had been associated with Mr. J. S. Whitson on road construction in Northern Ontario.

At Toronto, Ont., a by-law will be submitted on January 1 to authorize the construction of a civic car line in North Toronto, at an estimated cost of $455,000. The project is to include the running of lines south from Earlscourt, Hillcrest and Wychwood districts.

According to an estimate supplied by the city engineer, the cost of building a bridge to connect South London with the south end of Richmond street would be approximately $37,000, the steel work alone costing $25,500. The bridge would have a length of 650 ft. with a span of 190 ft.

At St. Catharines, Ont., a plan has been proposed by the City Water Commission by which Port Dalhousie will receive a water supply from the city system, the village to lay a main to the city limits. They will also be required to maintain it and contribute a rate to be agreed upon later.

The Harbor Commissioners of Hamilton, Ont., are considering a scheme for the widening of Desjardins Canal to 300 feet and dredging it to a depth of 25 feet, with turning basins. It is proposed to reclaim the remaining marsh area and to have regulation roadways, 66 feet wide, along either side of the banks.

It is pleasing to record that the foundry of Messrs. Thompson & Sutherland, N. Sydney, N.S., which has been out of commission since its partial destruction by fire last September, has been reopened. All the old staff has been re-employed and it is expected that sufficient work will be forthcoming to keep them engaged throughout the winter.

Good progress is being made on the steel work of the new building which the Excelsior Life Association is erecting in Toronto at a cost of $500,000. The building is to be eleven storeys high, of steel, terra cotta and brick construction. The architect is Mr. E. J. Lennox, and the general contractors are Messrs. Peter Lyall Construction Company.

At Ford City, Ont., the new factory for the Ford Motor Company of Canada is well advanced on the way to completion. The building is six storeys, 200 x 195 feet, steel and reinforced concrete construction, and will cost, when completed, about $300,000. Messrs. John Graham & Company, Windsor, are the architects and Messrs. Wells & Gray, Windsor, the general contractors.

The Canada Electric Company, Montreal, have secured a contract for electrically equipping the new Customs house, Ottawa, which is being constructed by Peter Lyall & Sons Construction Company, Limited. Six transformers will step down the current for lighting and power purposes. The elevators, ventilating, pumping, and heating systems will be electrically operated, direct connected motors being installed.

Expenditures totalling $6,000,000 have been made on the Welland canal work this season, and the four contracts under way are one-quarter completed, according to a report from Ottawa. Four sections are yet to be contracted for, but they are so located that it is not advisable that they be let until the work on the existing contracts is further advanced. It is estimated that the canal work will be completed in two years.

The firm of Kerry & Chase, Consulting Engineers, Toronto, have been appointed to consider and advise regarding the feasibility of constructing a mountain-top reservoir in connection with the projected scheme of Hydro and City Water-Works amalgamation at Hamilton, Ont. A large number of applications for the position were received at fees ranging from $10,000 to $700. The engineers will proceed with the work as soon as the appointment has been ratified by the Board of Control.

The new plant at Longueuil, Que., for the firm of Armstrong & Whitworth, of Canada, Limited, is almost completed and it is expected that all branches of the building will be in operation during December. From the outset some 200 men will be employed and this staff will be augmented as the market improves. It is the intention of the company to manufacture a high-grade of crucible steel which up to the present has not been made in Canada. The announcement has also been made that a projectile shop will possibly be built next year. Armstrong & Whitworth plants in England are at present working to capacity, the firm having in their employ over 50,000 workmen. The bulk of the labor is devoted to the manufacture of British Government requirements.

WESTERN CANADA

The new school building erected at the corner of Helen and Fleet Streets, Winnipeg, at a cost of $150,000 is nearing completion. The building is of stone, brick, and reinforced concrete construction.

Plans are in preparation by Mr. Geo. Schioler, Bridge Engineer, for the construction of a new bridge over the Lee River near Lac du Bonnet, Man., on the city's Power Plant Tramway, at an estimated cost of $20,000.

Foundations are in for the new court-house which the Saskatchewan Provincial Government is building at Swift Current at a cost of over $100,000. The building is to be two storeys high, of stone, brick and reinforced concrete construction. The general contractors are Messrs. R. J. Lecky Company, Limited, Regina.

The Dominion Government is expending the sum of $4,500,000 on public works in the vicinity of Victoria, B.C. This outlay does not include the Esquimalt Dry Dock, upon which construction will be started in the near future.

Finishing touches are being put on the new "Balmoral" school which has been erected at Crescent Heights, Calgary, at a cost of $185,000. The building is three storeys high, of limestone and fireproof construction. The general contractor is Jas. McPhail, Calgary.

At Victoria, B.C., the Hudson's Bay building now under construction by the British Columbia Construction Company is to be completed four storeys as originally planned. For some time the board of directors have been considering the advisability of completing only three storeys.

Exterior work is reported to have progressed rapidly on the new armoury which the Dominion Government is building at Edmonton at a cost of $286,000. The building is to be two storeys high, 175 x 275 ft. in dimensions, of brick and stone construction. The general contractors are Messrs. Peter Lyall & Sons.

At Burrard Inlet, B.C., the firm of Barnet, McQueen & Company, of Fort William and Minneapolis, have put in the lowest tender for the construction of a Pacific Terminal Elevator to be built here by the government at an estimated cost of $1,000,000. The storage capacity of the elevator will be one and a quarter million bushels.

The new school building which the Winnipeg Public School Board is erecting on Manitoba Avenue at a cost of $150,000, is practically completed. The building is three storeys high, of brick and reinforced concrete construction. The architect is Mr. J. B. Mitchell, of Winnipeg, and the general contractors are Messrs. Claydon Bros., of Winnipeg.

At Winnipeg, Man., there is a possibility of a site for building purposes being selected by the Globe Pump Company of Green Bay, Wis., one of the largest manufacturers of deep well pumps on the Continent. The company are considering a scheme for locating a branch plant in Canada and with that object the manager, Mr. R. I. Byington, visited Winnipeg recently.

Plans are being prepared for the "Clark Drive" trunk sewer, which is part of the Vancouver and District joint sewerage scheme. The cost of this section of the work is estimated at $325,000. Constructional operations are to be put in hand as soon as the plans are completed. No decision has yet been reached as to whether to undertake the work by contract or by day labor.

The ratepayers of West Vancouver, B.C., voted last Saturday on a by-law to raise $150,000 for the installation of a water-works system. At the time of going to press the [illegible] had not been [illegible] of the result. Plans of the system were prepared by Mr. H. [illegible]. The proposed source of supply is at the head of [illegible] Creek. It is hoped to start work in January.

The City Council of New Westminster, B. C., have authorized the Water Committee to proceed with the construction of a new reservoir to increase the city's available water supply. The work is to be done by day labor under the superintendence of the board of works. The reservoir will have a capacity of 5,000,000 gallons. Its construction will involve the excavation of [illegible] cubic yards of earth.

The Hudson Bay Railway is practically completed from Le Pas, Man., to Thecket Portage, a distance of 180 miles, according to official reports to the railway department. On the second section to Split Lake, steel is now being laid, while on the third section, between Split Lake and Port Nelson, clearing and grading is well advanced. The work will go on this winter and completion is looked for early in 1916.

Announcement was made by Mr. J. W. Stewart, President of the Pacific Great Eastern Railway, on his return from a trip over the route of the new line from Squamish to Fort George, that judging by the present rapid rate of progress, grading would probably be completed on the entire road by the end of the year. Track laying is proceeding beyond Pembleton and is nearing the summit at the head of Anderson Lake, about 85 miles from the Ocean Terminal. There are about 6,000 men employed on grading operations, notwithstanding that the completion of several sections of grading has resulted in reductions. As is generally known, the extension is planned to connect with the Edmonton and Dunvegan Railway on which construction work is understood to be well advanced.

The MacArthur Concrete Pile & Foundation Company have sold to the Oriental Compressol Company of Tokio, Japan, the patent rights to drive the pedestal pile in Japan. The MacArthur Concrete Pile & Foundation Company have appointed Douglas-Milligan Company as their Sales Agents for Eastern Canada, with main office in the New Birks Building, Montreal, and branch office at 95 King street east, Toronto.

Bulletin B.10 of the Herbert Morris Crane & Hoist Company, Limited, Toronto, contains some illuminating details as to the manufacture and possibilities of Morris chain-blocks. One of the illustrations shows the largest standard chain-block in the world—made for a load of sixty tons. An idea of its proportions is conveyed by a chain block of one-quarter ton capacity which has been photographed alongside the larger product. All Morris chain blocks are subjected to a fifty per cent. overload test. In this case it is ninety tons.

The Glengarry and Stormont Railway, connecting Cornwall with St. Polycarpe Junction, on the Canadian Pacific Railway, is expected to be in operation at the beginning of 1915. The total cost of the line is given as $875,000. Nearly all the construction material was purchased in Canada, although two steam shovels costing about $10,000, a steel water tank costing $4,000, and $3,000 worth of dumping wagons were bought from concerns in the United States. The rolling stock, to consist of about 4 engines, 30 passenger coaches, 60 freight cars, and 20 construction cars, is either to be purchased or to be supplied from the equipment of the Canadian Pacific Railway. Quotations, c.i.f. Montreal, should be sent to C. L. Harvey, president of the Glengarry Construction Company, 400 St. James Street E., Montreal.

The MacArthur Concrete Pile & Foundation Company have appointed The Douglas Milligan Company their Sales Agents for Eastern Canada, with main office in the New Birks Building, Montreal, and branch office at 95 King Street East, Toronto. The MacArthur Concrete Pile & Foundation Company are equipped to construct foundations for all sorts of structures where unfavorable soil conditions are encountered. They have already done a large amount of this work both in Canada and the United States. [illegible] by this company in Canada includes foundations for two large buildings at the plant of the Oliver Chilled Plow Works, Hamilton, Ont.; power house at Mt. Dennis, Toronto, for The Canadian Kodak Company; all of the large ship-building plant of the Canadian Vickers, Limited, Montreal; Canadian Postal Station [illegible], Montreal; Immigration [illegible] for the Canadian Government at Quebec; power house for Dorchester Electric Company, Quebec; and piles for an international bridge across the St. Johns River at St. Leonards, N.B.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Burlington, Ont. (Hamilton)

All material except meters and ¾-in. lead pipe has been purchased in connection with waterworks construction for the village council, at an estimated cost of $12,000. Mr. James S. Allen is village clerk.

Hamilton, Ont.

Bids addressed to Mr. R. F. Miller, 501 Bank of Hamilton Building, will be received for digging and laying 15 miles of gas mains along city streets for the Natural Gas Company.

Hull, Que.

The ratepayers will vote on a by-law next January to authorize the enlarging and extension of watermains through the Municipality. Estimated cost $100,000. Mr. J. A. Laforest, Town Hall, is the town engineer.

Maisonneuve, Que. (Mont.)

Plans are drawn and together with specification have been submitted to city council for improvements and paving to Pius IX. Boulevard, 100 ft. wide with 12 ft. sidewalk on each side. Approximate length 4 miles. Mr. M. Dufresne, Ontario Street, is the architect and engineer.

North Vancouver, B.C.

A by-law has been passed authorizing the expenditure of $75,000 by the Municipal Council on paving work. Mr. A. M. West is city engineer. Mr. J. Cowlins, city clerk.

Nanaimo, B.C.

Construction will be started shortly on asphaltic concrete pavement on Haliburton Street, from Grace Street to city limits, at an estimated cost of $37,764. The city engineer is Mr. Owen and city clerk Mr. S. Gough.

Ottawa, Ont.

Work is proceeding on the construction of trunk sewer on Nicholas Street at an estimated cost of $3,500 by the City Council. Work is being done by day labor. Mr. R. L. Haycock is the engineer.

Montreal, Ottawa and Georgian Bay Canal Company will apply to Parliament next Session for an extension of time for the construction of the Georgian Bay Canal. This is a private company which is said to own a charter to build the proposed waterway.

Tenders will be called for balance of work, which includes asphalt pavement between Elgin and Bank Streets, estimated cost $16,600. Mr. F. C. Askwith is the city engineer.

The city council will take tenders on the balance of asphalt pavement work between 5th Avenue and Centre Street estimated to cost $8,500.

Work on grading of Scott Street, between Merton and Garland, will be done by day labor.

In connection with $62,000 asphalt and stone block pavement on Bank Street, between Echo Drive and Riverdale, the surface drainage of which has been started by day labor, tenders will be called shortly for balance of work. Mr. F. C. Askwith is the city engineer.

Peterborough, Ont.

The City Council has instructed Mr. Parsons, City Engineer, to prepare plans and estimate for surface drainage in various parts of the city .

Port Coquitlam, B.C.

Debentures have been sold and the first installment of 8,000 will be used immediately in connection with the carrying out of road improvements here at an estimated expenditure of $100,000.

Saskatoon, Sask.

Plans have been filed for the construction of a 24-in. force watermain under the South Saskatchewan River, from 11th to 6th Streets. Mr. Junius Johnson is city engineer. Mr. A. Leslie is city clerk.

Toronto, Ont.

The recommendation of Mr. Harris, Commissioner of Works, has been approved by the Works Committee, for the opening of a roadway through Mount Pleasant Cemetery. Two small bridges, 112 ft. foot bridges and 180 ft. trestle, will be constructed. The scheme will cost approximately $275,000.

The following pavement work has been recommended for this city:—Asphalt on Rowland, Fisken, Vernon, Jennings, Glenwood & Kennedy; estimated cost $21,779. Brick block, Hain, Evelyn, Glenwood, Indian Road Crescent, Hillsview; estimated cost $22,202. Treated wood block on Front Street West, at an estimated outlay of $17,120. Mr. R. C. Harris is Commissioner of Works.

Tenders close on December 22nd with Board of Control for sewers on Bastedo, Concord, Delaware, Earlham, Merrill, Ridge, Roseheath, Rose Park Drive, Sawden, Sprott, Stacey, Stanton & Keswick. Plans are at office of Works Department, City Hall.

The construction of concrete curbings on six streets at an estimated cost of $4,164 has been recommended by Works Commissioner, Mr. R. C. Harris.

The Commissioner has recommended a 66 ft. roadway through Prospect Cemetery at an estimated cost of $30,000.

Winnipeg, Man.

Tenders will be received by Board of Control until December 11th for laying sewers at an approximate cost of $11,000. Two-thirds of labor is to be obtained through Civic Equipment Bureau in two shifts. Plans and specification are at office of engineer, Mr. W. P. Brereton, 223 James Street.

CONTRACTS AWARDED

Brooke Twp., Ont.

The general contract to lay drains here for the township council has been awarded to Woolman Construction Company, Sandusky, Mich., at $6,812. Work is to start at the beginning of April. A number of culverts not included in the general contracts will be constructed. Mr. W. J. Bourne, Lot 13, Con. 6, Brooke Twp., Alvinston, Ont., is township commissioner.

Railroads, Bridges and Wharves

Chatham, Ont.

No contract work will be done this year on bridges under construction for the City Council and Dover Twp. Steel work on nine bridges has been completed and steel work is under way on other two. Mr. J. E. Doyle, Cross Street, is the engineer.

Cranbrook, B.C.

The Canadian Pacific Railway Company have been authorized to construct a spur line into the premises of Yahk Lumber Company, Limited, Cranbrook.

Hamilton, Ont.

A High-Level Bridge at Carroll's Point, estimated to cost $327,000, will probably be erected under the supervision of Toronto-Hamilton Highways Commission. Bridge plans have been prepared by the Hamilton Bridge Company. Concrete plans are to be submitted by the Canada Cement Company. Mr. George H. Gooderham, Toronto, is Chairman, Highways Commission.

Repair work by day labor will be carried out on revetment wall for Harbor Commissioners, estimated to cost $20,000. Work will be concrete construction. Mr. H. E. Waterman, 67 James Street S., is secretary.

Leamington, Ont.

Tenders will be received until Thursday evening, December 10th, for drainage work on 6,500 feet of open drain, 3,371 feet of 48-in. and 1,456 feet of 36-in. reinforced concrete tile or segment block; 5,891 feet of 30-in. and 20-in. glazed sewer tile; also construction of concrete highway bridge. Along covered section which lies mostly through the town a connection will be left for each block. Plans and specification are at office of engineer, Mr. John A. Baird. Estimated cost of work, $25,000. Mr. R. M. Selkirk is town clerk.

Province of Alberta

The Canadian Northern Railway will construct a spur line for Rosedeer Coal Company, Limited, Rosedeer; a spur to serve the Star Coal Mines, Limited, and a spur to serve Alberta Block Coal Company, Limited.

Province of Manitoba

The Canadian Pacific Railway Company are constructing a railway spur for the Empire Water Works Supply Company, Limited, Winnipeg; Dominion Lumber & Fuel Company, Limited, and T. D. Robinson & Sons, Limited.

Port Arthur, Ont.
A contract for the construction of concrete docks at the Canadian Northern Coal & Ore Docks at Port Arthur, has been let to the Barnett & McQueen Company. The work will be commenced as soon as heavy equipment can be moved across the ice. The contract amounts to approximately $600,000.

Province of Ontario
Lake Erie & Northern Railway will construct a spur across Mill Pond near Galt, Ont.

The Canadian Pacific Railway will construct an extension to siding for the Toronto Carpet Manufacturing Company, Parkdale.

The Grand Trunk Railway Company will construct a siding into the premises of the Ford Motor Company in the Township of Sandwich, Essex County.

Shields, B.C.
The Board of Railway Commissioners has authorized the Canadian Pacific Railway Company to re-construct a bridge near Shields.

St. Liboire, Que.
Plans have been approved by the Railway Board of Commissioners for a station which it is proposed to erect at St. Liboire for the Grand Trunk Railway.

Toronto, Ont.
A permit to erect a five-storey warehouse at a cost of about $50,000 has been taken out by Messrs. Anderson & McBeth. The building will be erected on the north side of King Street, near John Street.

The city council has decided not to submit by-law on January 1st to raise an additional $167,000 for construction of Gerrard Street bridge.

By-low will be submitted January 1st for authority to construct new civic car lines in north Toronto and run south from Earlscourt, Hillcrest and Wychwood districts, at an estimated outlay of $155,000. Mr. R. C. Harris, City Hall, is Commissioner of Works.

CONTRACTS AWARDED

Quebec, Que.
Contracts have been awarded as follows in connection with repairs to the "Commercial" Academy, at an estimated cost of $5,000: General contract and plastering, Mr. C. N. Paradis; carpentry, L. H Peters, Limited; roofing, Mr. Eugene Falardeau. No other contracts are required. Mr. J. S. Bergeron, 103 St. John Street, is the architect.

Public Buildings, Churches and Schools

Beaver Lodge, Alta.
Happy Valley School District No. [illegible] have in contemplation the erection of a school building shortly. Mr. C. J. Robertson, Beaver Lodge, is a trustee.

Burnaby, B.C.
A specification is being prepared by Mr. J. H. Bowman, Yorkshire Building, Vancouver, and tenders on separate trades will be called at [illegible] construction of a brick and stone school building at an estimated cost of $50,000 for the School Board. Mr. Burns is the trustee.

Bluesky, Alta.
The School District of Bluesky, No. 3,193 (Trustee, Mr. A. Bourget), intend erecting and equipping a school building in the near future.

Church Point, N.S. (Digby Co.)
St. Anne French Catholic Church has been damaged by fire. A loss of $1,500 has been sustained through damage to spire.

Cereal, Alta.
Cereal School District No. 3192 will erect a school building shortly. Mr. A. D. Bussard, Cereal, is a trustee.

Del Bonita, Alta.
School District of Richfield No. 3,198 (Trustee, Mr. Millar, Del Bonita) is contemplating the erection of a school in the near future.

Glevennah, Alta.
Glevennah School District No. 3,195, have decided to erect a school building shortly. Mr. W. J. Nickel, Glevennah, is one of the trustees.

Guelph, Ont.
A By-law will be submitted to the ratepayers in January to authorize the expenditure of $125,000 for an addition to the Collegiate Institute on Paisley Street for the Board of Education. Mr. J. M. Duff, Bank of Commerce, is the chairman.

Hawkesbury, Ont.
Prices on painting, heating, plumbing, electric work and interior fittings are to be taken by Father Gascon, parish priest, in connection with $25,000 school building for the R. C. School Board. Mr. A. D. Gascon, c/o Vandal & Gascon, 202 Main Building, St. Lawrence St., Montreal, is the architect.

Kinsella, Alta.
A school building will be erected shortly by the School District of Kinsella No. 3,190 (Trustee, Mr. C. Bridgeman, Kinsella).

Mahaska, Alta.
The erection of a school here will be started shortly by the North Derby School District No. 3196. School equipment will also be purchased. Mr. W. F. Taylor, Mahaska, is trustee.

Milltown, N.B.
Tenders will be received by Mr. R. C. Desrochers, Ottawa, Secretary of Dominion Dept. of Public Works, until 4 p.m. December 18, for interior fittings in Post Office and Customs House, including [illegible] furniture, wickets, drawers and marble work. Plans and specifications are at the offices of Mr. John H. Porter, Clerk of Works, Milltown; Mr. D. H. Waterby Clerk of Works, St. John, N.B.; and at Department at Ottawa. Specification at offices of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Mt. Dennis, Ont.
Trustees of School Section No. 28 have [illegible] to cost $30,000. Messrs. Ellis & Connery, Manning Chambers, Toronto, are the architects. Mr. J. Marshall, Weston Road, is the secretary.

Newmarket, Ont.
Tenders will be received until 4 p.m. December 16, by Mr. R. C. Desrochers, Ottawa, Secretary, Dominion Government Department of Public Works, for interior fittings in Post Office and Customs House, including oak, pine and wire screens, wickets, shelving, counters, desks, drawers, blackboard, cupboards and wardrobe, marble work and vault fittings. Plans and specifications are at the offices of Mr. Frank Stewart, Clerk of Works, Newmarket, Mr. T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and Department at Ottawa. Specification at offices of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Owen Sound, Ont.
The ratepayers here will vote on a by-law to raise $6,000 for alterations to town hall, municipal offices and market facilities. Mr. Chas Gordon is the town clerk.

Prince Rupert, B C.
No contract has yet been awarded but excavation will be started shortly by day labor on the Court House, etc., to be erected by the Provincial Government Department of Public Works, at an estimated cost of $150,000. Mr. A. A. Cox, Carter-Cotton Bldg., Vancouver, is the architect. Hon. Thomas Taylor, Victoria, is Minister of Public Works.

Rimbey, Alta.
Rimbey School District No. 3,187 have in contemplation the erection of a school building here. School equipment will also be purchased. Mr. C. S. Stollings, Rimbey, is a trustee.

Sawridge, Alta.
A school building will be erected and [illegible] by the Sawridge School District No 3,197. Mr. H. T. Cooper, Sawridge, is one of the trustees.

St. Felicien, Que.
Tenders for painting will be called next spring in connection with $125,000 [illegible] for the Parish of St. Felicien. Mr. Jos. Poullet, 28 St. Famille St., is the architect, and Mr. Edm. Tremblay, St. Felicien, is the general contractor.

Toronto, Ont.
Permission has been granted by the city council to the Board of Education to advertise for necessary equipment to [illegible] Technical High School. Tenders for power plant equipment close [illegible] January. School equipment will cost about $284,395. Mr. W. C. Wilkinson is secretary of Board of Education.

Property Commissioner Mr. C. C. Chisholme, has been authorized by the city council to convert Assembly Hall into offices for use of the City Architect's Department. [illegible] Work will be done by day labor.

Tenders close December 11, at 4 p.m. [illegible] construction. Mr. W. C. Wilkinson is secretary-treasurer of Board of Education.

Virden, Man.
The [illegible] Department of Public Works, Mr. R. C. Desrochers, Ottawa, will receive tenders

[illegible] December 24, for interior fittings in Post Office and Customs House, including oak and wire screens, wickets, doors, ½-in. plate glass slabs, shelving, cornice, pigeon holes, counters, desks, tables, cupboards, wardrobe, blackboard, also marble work. Plans and specification at offices of Mr. N. B. Walker, Clerk of Works, Virden; H. E. Matthews, [illegible] Architect, Winnipeg; at Post Office, Brandon, and at Department, Ottawa. Specification at the office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto. Mr. E. L. Horwood is the Architect.

Weston, Ont.
Weston Lacrosse Club have in contemplation the erection of a Club House on the Fair Grounds. Dr. E. F. Irwin is a member of the committee.

Wetaskewin, Alta.
Permission has been granted by the Provincial Government to raise funds for the erection and furnishing of a school building for Wetaskewin School District No. 550 (Trustee, Mr. P. W. Strand, Wetaskewin).

Bulyea School District No. 3,191, will erect a school building shortly. Mr. O. E. Olson, Wetaskewin, is a trustee.

CONTRACTS AWARDED

Belleville, Ont.
The following contracts have been awarded for $11,000 addition to church building for Methodist Church Congregation: Steel work, Walker Foundry; roofing, Brantford Roofing Company; painting, Mr. John Cornelius; plumbing, Smith Hardware Company; electric work, Greenleaf & Son; mason and carpenter work, will be done by day labor. Contract for plastering has not yet been let. No interior fittings will be required. Building will be of stone and brick construction, stone foundation. Messrs. G. M. Miller & Company, Toronto, are the Architects. Mr. R. P. White is the general contractor.

Brantford, Ont.
The general contract for Smallpox Hospital at Mount Hope Cemetery has been let to Mr. Wm. J. Adams, at $3,360. The contract for furnishing has not yet been let. Hospital will be one-storey, 45 x 35, brick construction. Barber & Tilley, Temple Building, are the architects.

Toronto, Ont.
The following contracts have been awarded by the Board of Education in connection with the North Toronto High School 12room addition, brick construction: Heating, J. R. Seager Company, Toronto, $6,995; heat regulating, National Regulation Company, New York, $850. Mr. W. C. Wilkinson is Secertary, Board of Education.

The Board of Education has cancelled the award of plastering contract to Haddock & Sons and re-awarded it to Mr. Geo. White, at $4,975. The contract is in connection with the $100,000 school building on Regal Road.

Victoria, B.C.
The contract for an addition of Manual Training and Domestic Science Building to South Park School, at a cost of $8,000, has been awarded by the School Board to Luney Bros. Mr. J. C. M. Keith, 416 Sayward Building, is the Architect.

Business Buildings and Industrial Plants

Bayham Twp., Ont.
The erection of farm buildings estimated to cost $4,000 is contemplated by Mr. C. O. Edison, Vienna P.O. Building will be fireproof construction, stone and concrete foundation.

Bienville, Que.
A store, the property of Mr. Gust Lemieux, has been destroyed by fire, incurring a loss of $11,000. Store was insured and will be rebuilt. Owner will purchase store fronts.

Barrie, Ont.
Contracts for plastering, painting, heating, plumbing and electrical work have not yet been let in connection with the construction of $57,000 drill hall, two-storeys, 80 x 177 ft., reinforced concrete and brick construction for Dominion Government Department of Public Works. Mr. R. C. Desrochers, Ottawa, is the secretary, Mr. W. A. Tom, Collingwood, is the general contractor.

Belleville, Ont.
The Balmoral Hotel, Front Street; Black's restaurant and a fruit store have been destroyed by fire. Loss is estimated at $35,000.

Dundas, Ont. (Hamilton)
Alterations to stores, etc., at an estimated cost of $1,600, are to be carried out by Mr. F. A. Nelson, King Street, Dundas. Plans provide for new store front, brick columns.

Hamilton, Ont.
Tenders for roofing Steam Plant for Dominion Power Transmission Company are now being received by the owners. All other sub-contracts have been awarded. The building will be completed next summer. Pratt & Perrine, 36 James Street South, are the architects. Mr. Chas. H. Hutton, Terminal Station, is Superintendent-in-Charge.

Plans are drawn for an office and coal shed to be erected on Wentworth north, for the Hamilton Lumber Company. Building will be one-storey, frame construction.

Harriston, Ont.
Poultry building owned by Gunn's, Limited, Toronto, has been destroyed by fire.

Lennoxville, Que.
Barns, implements and produce owned by Mr. J. H. Parker, Willowdale Farm, have been destroyed by fire. Estimated loss $15,000. Buildings were insured.

Montreal, Que.
Interior fittings for $8,000 picture theatre will be purchased by King Edward Theatre, St. Lawrence Street, owners. Building is 90 ft. high, 40 x 45 ft., steel, brick, stone construction. Mr. C. Dufort, 192 St. Catherine W., and Mr. F. T. Jackalin, Jacobs Bldg., St. Catherine Street, are the architects.

Prices will be received in a few days by the general contractor, Mr. B. Damiens, 894 Mount Royal Avenue E., for painting and heating, brick work and plastering in connection with two-storey, 25 x 86, brick store, estimated to cost $15,000.

Tenders will be called shortly on painting, heating and electrical work in connection with four-storey, 130 x 60 ft., terra cotta, brick and reinforced concrete addition to bakery for Mr. James Strachan, 246 City Hall Avenue. Estimated cost $100,000. Mr. Sydney Comber, 1215 Green Avenue, is architect, Messrs. P. Lyall & Sons Construction Company, Limited, Transportation Bldg., are the general contractors.

A six-storey addition may be made later to four-storey reinforced concrete store and apartments on Sherbrooke & St. Lawrence Streets for Mr. J. A. Godin, 269 St. Dennis Street. Construction Rationnelle, Limited, are the general contractors.

Tenders for steel work on three-storey, 100 x 25 feet stables on Western Avenue for Mr. Armand Malò, 100 St. Jerome Street, will be received by the architect, Mr. Sydney Comber, 1215 Green Avenue. Buildings will be brick and stone construction and will cost $20,000.

Tenders close shortly for contract to place stairway and doorway and to carry out alterations to store front at an estimated cost of $2,000 for Fineburg & Rabinovitch, St. Lawrence Street. Vandal & Gascon, 202 Main Building, St. Lawrence Street, are the architects.

Moncton, N.B.
The Moncton Tramway & Electricity & Gas Company are erecting a temporary car barn here. Plans for a permanent building, to be started next spring, will be prepared by Mr. F. A. Fretchet, 30 Bonecord Street.

New Westminster, B.C.
Plans are drawn for new market building on 10th Street, for the city council, estimated to cost $40,000. Plan provides for carrying wharf out 225 feet upon which frame building will be constructed. Mr. Powell, harbor engineer, is the architect, Mr. J. W. Blackman is the engineer, and Mr. W. A. Duncan, city clerk.

Ottawa, Ont.
Garage owned by Mr. H. Low, Dufferin Road, which was recently destroyed by fire will be rebuilt at an approximate outlay of $4,000. Building will be brick construction.

Interior fittings for two-storey, 50 x 72 ft., solid brick stores, estimated to cost $10,000, will be purchased by the owner, Mr. Geo. Labelle, 225 Rideau Street. Mr. Ernest Ewart is the general contractor.

Picton, Ont.
The Canning Factory, owned by Mr. Edward McCaw, has been destroyed by fire.

Peel, N.B.
Four warehouses estimated to cost $15,000 will be rebuilt to replace warehouses recently destroyed by fire. Work will be done by day labor. The owners are H. H. McCain Produce Company, A. A. Ridout, F. J. Haltfield, and D . Smith, all of Hartland.

Princeton, Ont.
Barn belonging to Mr. Robert Wilson, Con. 5, Blenheim Twp., Princeton P.O., has been destroyed by fire. The loss is partly covered by insurance.

Peterboro, Ont.
By-law will be submitted to ratepayers next January to grant the use of three miles of railway track. If by-law is carried the owners, The Canadian General Electric Company will spend $150,-

000 on plant and equipment to manufacture railway cars.

Quebec, Que.

The contract for painting $11,000 warehouse on Sault au Matelot for Messrs. Boivin & Grenier, Dalhousie Street, will not be let until next spring. One freight elevator will be required. Mr. D. Guerin, Beauport, Quebec, is the general contractor.

Springford, Ont.

The erection of farm buildings here, estimated to cost $3,200, is contemplated by Mr. J. C. Smart.

Sussex, N.B.

Store front and fittings are required by Mr. Geo. H. McArthur, Sussex and St. John, in connection with the construction of $10,000 store on Broad Street for Mr. Geo. W. Fowler.

Toronto, Ont.

Plans have been prepared by Mr. J. H. Haffa, 154 Bay Street, architect, for four attached stores and residences at an estimated cost of $5,000 for Mr. S. Rosenberg, 178 Grange Avenue. Buildings will be two-storeys, 56 x 42, brick construction and foundation. Owner will purchase all material and superintend construction.

The city council has refused permission to erect temporary car barns on Bloor Street W., in connection with civic tracks at present under construction.

Welland, Ont.

Barn and other buildings, the property of Mr. James Asher, Welland P.O., have been destroyed by fire. Estimated loss $5,000, insurance $1,500.

Windsor, Ont.

The contract for electrical work has not yet been let in connection with $12,000 theatre on Wyandotte for Messrs. Reaume & Tassie, Ford City, Ont. Building will be two-storeys, 115 x 35, artificial stone and brick construction.

CONTRACTS AWARDED

Ottawa, Ont.

The contract to construct $4,000 stores on Gladstone Avenue for Mr. S. W. Halliday, 20 Arlington Avenue, has been awarded to Mr. A. C. Burton, Ottawa.

Toronto, Ont.

The contract to carry out alterations and additions to stores at 286 Yonge Street at an estimated cost of $3,500 has been awarded by H. C. Blatchfard, Limited, 114 Yonge Street, to C. W. Wood & Son, Toronto. Messrs. Curry & Sparling, Bond Street, are the architects.

Vancouver, B.C.

The Dominion Government Department of Public Works have awarded the contract to construct a grain elevator on [illegible] to Messrs. [illegible] & McQueen, contractors, Fort William, Ont. Elevator will be structural steel and reinforced concrete, capacity 1,250,000 [illegible] will be [illegible] x 71 ft., workhouse, 126 x 62, elevator tower, 12 x 16. Mr. R. C. Desrochers, Ottawa, is secretary, Public Works Department

Residences

Hamilton, Ont.

Tenders on interior fittings for residence on Sanford Avenue South, are being received by the owner, Mr. W. F. [illegible] Sanford Avenue.

Maidstone, Ont.

The construction of a residence here is contemplated by Mr. Wm. Firth, Essex P.O. Building material has not yet been decided upon.

Montreal, Que.

A permit to build two flats has been issued to Mr. F. Tessier, 2703 Delormier

A permit has been issued to Mr. Louis Mercier, 186B Stradacona Street, for the erection of six flats at an estimated cost of $4,200, three-storey, 23 x 60.

Contracts for heating, plumbing and electrical work in connection with $10,000 flats on Addington Avenue have not yet been let. Mr. Charles Bernier, 70 St. James Street, is the architect. Mr. J. P. Tremblay, 423 Addington Avenue, is owner and general contractor.

Ottawa, Ont.

The construction of a two-storey, double brick veneer residence, estimated to cost $4,600, is contemplated by Mr. Arch. Davidson, 69 Grosvenor Street.

One, 2½-storey, 36 x 36, double brick veneer residence, will be constructed by Mr. M. A. Robinson, 73 Glen Avenue. Estimated cost $5,500.

The contracts for plastering, painting, heating, plumbing and electrical work on three residences under construction for Mr. Thomas Dean, 170 Cambridge Street, have not yet been let. Buildings will be brick veneer construction, felt and gravel roofing, and will cost approximately $6,500.

Prices will be asked shortly for plastering, painting, heating, plumbing and electrical work in connection with six residences under construction on Armstrong Avenue at an approximate cost of $12,000 for Mr. J. W. Foster, 11 Irving Street, and Mr. E. Marks, 30 Spadina Avenue, owners and general contractors. Construction will be frame and brick, concrete foundation.

Plans are drawn for a residence on Wurtemburg, estimated to cost $7,500. Mr. J. P. MacLaren, 104 Sparks Street, is the architect.

Plans are drawn by Mr. A. Tracy, Gladstone Avenue, architect, for $3,500 residence for Mr. W. J. Scobie, 201 Gladstone Avenue.

The erection of a $5,500 residence at Riverdale, brick construction, concrete foundation, is contemplated by Mr. B. A. Grison, 100 Fentiman Street, Ottawa.

Mr. A. Middlestake, O'Connor Street, has decided to build a brick veneer residence.

The construction of a $4,500 residence on Pansy Avenue, double brick veneer construction, stone foundation, is contemplated by Mr. John McCallum, 54 Glen Avenue.

All work will be done by day labor on repairing of the [illegible] of Mr. Louis Charson, 375 Catherine Street, after fire. Alterations will cost about $3,000.

Port Perry, Ont.

Work will be stopped for the winter on the construction of a [illegible] here for the Carnegie Milling Company. Contracts for heating, plumbing and painting will be let next March by the architect and general contractor, Mr. A. J. Carnegie, Water Street.

Zurich, Ont.

The erection of a residence, white brick superstructure, concrete foundation, estimated cost [illegible], is contemplated by

Mr. Fred Daters, Sr., owner and architect.

CONTRACTS AWARDED

The contract to erect a $7,000 residence on Coburg Road for Mr. G. A. J. Boak, 123 Coburg Road, has been let to Maxner & Dunlop, Halifax, N.S. Mr. Herbert E. Gates, Dennis Bldg., is the architect.

Westmount, Que. (Montreal)

The contract for $3,500 residence on Clarke Avenue has been awarded to Mr. John Allan. Messrs. Nobbs & Hyde, New Birks Bldg., Montreal, are the architects. Mr. M. A. Phelan, 4233 Montrose Avenue, is the owner.

Power Plants, Electricity and Telephones

Exeter, Ont.

The town council contemplates installing electric power for lighting and general purposes. Mr. T. B. Carling is the town clerk.

Montreal, Que.

Tenders will be received until December 15, by Mr. L. N. Senecal, Secretary, City Hall, for the contract to erect a pumping station in connection with the Elgin Basin Sewers. Estimated cost of station, $5,500. Plans and specification are at office of engineer, superintendent of sewers.

Toronto, Ont.

Toronto Hydro-Electric Commission, 226 Yonge Street, will receive tenders until December 17, for single-phase regulators. Specification at office of Purchasing Department.

Tenders close December 22nd with the Board of Control for one or more 20,000,000-gallon centrifugal pumps. Plans, etc., are at Room 12, Purchasing Department, City Hall.

CONTRACTS AWARDED

Niagara Falls, Ont.

The following contracts have been awarded by the city council in connection with electric lighting scheme on River Road:—Pollard Mfg. Company, for supply of 100 ornamental iron standards, at $22 each; Brown Boggs Company, supply of pole tops, at $23 each; Northern Electric Company, Toronto, for cable; Westinghouse Company of Canade, Toronto, for 2 regulators, etc., at $1,493. Work is to be done by day labor under the supervision of Mr. George Foster, Engineer.

Stamford Twp., Ont.

The township council has awarded the general contract to construct a pump house, [illegible] concrete block construction, to the Frontier Construction Company, c/o F. E. Franz, Niagara Falls South. Mr. J. C. Gardner, Queen Street, Niagara Falls, is the engineer

Miscellaneous

Hamilton, Ont.

Tenders close December [illegible] for the supply of [illegible] extending over a period of one, five and ten years respectively. Specification is at the office of city engineer Mr. A. F. Macallum

St. Catharines, Ont.

Tenders will be called shortly for sections [illegible] and [illegible] New Welland Canal.

(Continued on page [illegible])

Tenders and For Sale Department

Tenders for Crushed Stone and Screenings

[illegible] Allan, Esq., [illegible] Board of Control, City Hall, Hamilton, [illegible] will be received by the undersigned up to 5 o'clock p.m. on **Monday, December 21 1914** [illegible] the Corporation [illegible] crushed stone and screenings for periods of one, five and ten years. [illegible] of tender to [illegible] City Engineer, City Hall, Hamilton, Ontario.

A marked cheque for $500 must accompany [illegible] be forfeited should the party whose tender is accepted fail to execute the necessary contract.

S. H. KENT,
City Clerk.

49-50

Tenders for the supply of Cast Iron Pipe

Notice is hereby given that the date for receiving tenders for the supply of 567 feet of 48 in. Cast Iron Pipe and 400 feet of 66 in. Cast Iron Pipe has been extended from noon on Tuesday, December 8th, 1914, to noon on **Tuesday, December 22nd, 1914.**

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, December 2, 1914. 49

Tenders for the Supply of Steel Pipe

[illegible] registered post only, addressed to the Chairman of the Board of Control, City Hall, [illegible] Tuesday, **December 22nd, 1914**, for the supply of:—

567 feet of 48-inch Steel Pipe.
400 feet of 66-inch Steel Pipe.

[illegible] be plainly marked on the outside as to contents.

[illegible] obtained at the office of the Commissioner of [illegible]

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, December 2, 1914. 49

To Contractors

Sealed tenders for the erection of a Masonic Temple on Spadina Road, Toronto, according to plans and specifications which may be seen on application at the offices of Messrs. Burke, Horwood & White, Architects, 229 Yonge Street, Toronto, and at my offices, will be received by Messrs. Burke, Horwood & White and by myself till 5 p.m. on **Thursday, December 24th, 1914.** The lowest or any tender will not necessarily be accepted.

H. P. KNOWLES,
49 1170 Broadway, New York, N.Y.

Tenders for Sewers

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, December 22nd, 1914**, for the construction of the following sewers, viz.:—

Bastedo Ave., Danforth Ave. to south end.
Concord Ave., Hallam Street to 159 ft. north.
Deleware Ave., Hallam St. to 296 feet north.
Earlham Ave., south limit lot No. 47, Plan 514 E, to Sproatt Ave.

Glendu Ave., Doel Ave. to Sproatt Ave.

Kiswick Drainage System Outlet from Lane first south of Gerrard Street and Marjory Ave. to Kiswick Ave. and Boultbee Ave. via Marjory Ave., lots 30 and 4, G. T. R. Right-of-way, Egan Street, Smith Street and Kiswick Ave.

Merrill Ave. West, West Lynne Ave. to Roseheath Ave.
Ridge Ave. west end to east end.
Roseheath Ave., Danforth Ave. to Copeland Ave.
Rose Park Drive, Welland Ave. to east end.
Sawden Ave., 195 feet east Hastings Ave. to Alton Ave.
Sproatt Ave., 200 ft. east Hastings Ave. to Greenwood Ave.
Stacy Street, 100 ft. west Bastedo Avenue to Roseheath Ave.
Stanton Ave., 204 feet east Hastings Avenue to Greenwood Avenue.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, December 2, 1914. 49

FOR SALE

One No. 6 Kennedy Gyratory Stone Crusher with extra shaft and head. One extra eccentric and one new bevel gear and pinion. Elevator complete, sixty feet long, including belt tightener, etc. One revolving screen, five by twelve feet, with shafting, pulleys, etc. One main drive belt. All in good condition. Can be seen at Credit Forks. Price reasonable. For price and terms address Box 111, Contract Record, Toronto. 48-49

Salesman and Buyer Going to Europe

Experienced and reliable salesman and buyer for building and architectural materials who is going to Europe, solicits business for Canadian manufacturers and dealers. Reply at once to Box 114, Contract Record & Engineering Review, Toronto. 49

Wanted Employment

To Contractors

Office man desires position. Experienced in book-keeping, time-keeping and cost. Aged 31 and married. Former employer (with whom I have been for four and a half years) has no further contracts. Moderate salary to start. Box 113, Contract Record, Toronto. 49

Miscellaneous

(Continued from page 63)

Canal at present under construction by the Dominion Government Department of Railways and Canals. Concrete walls on sections one and five are now being put in. Mr. J. L. Weller, St. Catharines, is superintendent of construction. Mr. W. T. Pugsley, Ottawa, is secretary of Department.

Toronto, Ont.

Tenders close December 22, with Mayor H. C. Hocken, for the supply of 567 ft. of 48in. steel pipe and 400 ft. of 64-in. steel pipe. Plans are at office of Commissioner of Works, City Hall.

Tenders close December 22 for all trades—Masonry, carpentry, painting, glazing, electric wiring and fixtures, heating and plumbing, in connection with new park shelter in Withrow Park. Plans and specification are at the office of the City Architect, City Hall.

CONTRACTS AWARDED

Montreal, Que.

Contracts for the supply of 3,304,000 feet B.M. lumber (hemlock, longleaf, yellow pine, elm, maple, Douglas fir and oak) have been awarded by the Harbor Commissioners to W. H. Kelly Lumber Company, Buckingham, Que.; Mr. G. W. Dansereau, Grenville, Ont.; and Mason, Gordon & Company, Montreal. Mr. R. W. Cowie, 47 Common Street, is the engineer.

Toronto, Ont.

Contract for one 20-ton hand-operated travelling crane has been awarded by the Board of Control to the Herbert Morris Crane & Hoist Company, Limited, at $1,907.

Late News Items

Brooke, Ont.

A railway siding is to be constructed in the near future to serve the Sugar Beet Growers in this district. Mr. Davidson, York Street, London, is the Superintendent.

Blenheim, Ont.

Plans are being prepared by Mr. Garnet Thomson, for 1½-storey white brick residence estimated to cost $3,500.

Falkirk, Ont.

Machinery and raw material will be required by Messrs. Batch & Rippin, who are contemplating the manufacture of cement tile for farm purposes.

Hamilton, Ont.

The Provincial Board of Health has approved of $300,000 section of storm overflow system. Bylaw to authorize the carrying out of the work will probably be submitted January 1.

The general contract for the erection of a billiard room at an estimated cost of $2,500, has been awarded to Mr. M. H. Yeates, Hamilton. The building will be one-storey, brick construction.

La Salle, Que.

The town council has let the general contract for road grading to McDonnell & Dibbler, Montreal. The work will involve an outlay of about $89,000. Messrs. Beique & Charton, 513 Transportation Building, Montreal, are the engineers.

Lindsay, Ont.

Alterations to restaurant on Kent St., to include a new lunch counter, etc., are contemplated by Messrs. Taylor & Martin.

London, Ont.

Freight sheds on York Street, the property of the Grand Trunk Railway, have been destroyed by fire. Loss, estimated at $30,000, is covered by insurance.

Montreal, Que.

A permit to construct eight flats at Old Orchard Avenue, estimated cost $32,000, has been issued to Anglins Limited, 65 Victoria Street, owner and general contractor.

A permit to build twelve flats at an estimated cost of $6,000, 3 storeys, 60 x 45, has been obtained by Mr. A. Piche, 196 Bloomfield Street, owner and general contractor.

[illegible] construction of a concrete subway under the C. P. R., Park Avenue. The Dominion Bridge Company, Montreal, have the contract for the steel work, the general contractors being Messrs. Laurin & Leitch, 5 Beaver Hall Square, Montreal. Mr. L. Emile Vanier, 5 Beaver Hall Sq., is the engineer in charge. The subway will cost about [illegible]

[illegible] by the Board of Commissioners to provide for laying sewers on 11th Avenue and Pasteur St., at an estimated cost of $13,060. Mr. L. [illegible]

The erection of stores and apartments is contemplated by Mr. L. M. Giasson, [illegible] Avenue.

[illegible] sioner for the year ending June 30, 1914, [illegible] are under construction, and over 1,400 miles have been authorized by Parliament but are not yet begun

Moose Jaw, Sask.

The Canadian Pacific Railway Company will construct a spur to serve the Moose Jaw Sand & Gravel Company. Mr. T. Martin is Divisional Engineer.

Ottawa, Ont.

Tenders will be received until January 8 for supplies to be delivered at Halifax, N.S., and Esquimalt, B.C., where specifications may be had at Naval Stores and Offices. The following supplies are required for the Dominion Government Department of Naval Stores (Deputy Minister, Mr. D. J. Desparatas): Metals—1. Steel angles, bars, sheets and plates; 2. iron bars; 3. babbitt metal, tin, antimony and aluminum; 4. brass bars, sheets and tubes; 5. copper bars, sheets and tubes; 6. lead sheet; 7. solder and spelter; 8. zinc plates; 9. wire rope. Miscellaneous. —10. paints, dry and mixed; 11. white lead; 12. red lead; 13. zinc oxide; 14. iron oxide; 15. marine dryers; 16. enamel; 17. varnish; 18. putty; 19. cleansing powder; 20. soap, hard, soft and castile; 21. tallow; 22. brooms and brushes; 23. polishing paste; 24. squeegees; 25. rubber sheet packing, etc.; 26. cotton waste.

Port Dalhousie, Ont.

A bylaw will be submitted to the ratepayers on January 4, to authorize the raising of $50,000 for the installation of a water-works system. Water is to be piped from the St. Catharines main at the boundary line. Mr. J. M. A. Waugh is the village clerk.

Quebec, Que.

Quebec Exhibition Commission is purchasing a merry-go-round, Ferris wheel, etc., for the Amusement Department of the Exhibition Grounds at an estimated cost of $10,000. Mr. George Morissette is superintendent of Commission.

St. Catharines, Ont.

The County Council of Lincoln proposes to erect a highway from Hamilton to Queenston. Negotiations on the subject are to be opened with Mr. G H. Gooderham, Toronto. The work will probably be undertaken by the chairman of the Toronto-Hamilton Highway Commission.

St. Marys, Ont.

The erection of a white brick residence at a cost of $4,000, is contemplated by Mr. S. L. Doolittle, Elgin Street.

Stamford Township, Ont.

The contract to supply 100 water connections has been awarded by the township council to the Canadian Brass Goods Company, Galt, at $4.74 each. Mr. F. C. Munro, Southend P. O., is the township clerk.

Toronto, Ont.

The following additional contracts have been let in connection with $60,000 school building on Carlaw Avenue, for the Board of Education: heating regulation, Johnson Heat Regulating Company, $1,073; terrazzo floors, Italian Mosaic & Marble Company, $690. Mr. W. C. Wilkinson is Secretary-treasurer, Board of Education.

Tenders will be received by the architect, Mr. H. B. Knowles, 1170 Broadway, New York City, and Messrs. Burke, Horwood & White, architects, [illegible] Building, Toronto, until December 24, for erecting Masonic Temple on Spadina Road, estimated to cost $300,000, for the Masonic Temple Corporation of Toronto, Limited. The building will be structural steel, stone and brick construction. Mr. W. H. Best, Osgoode Hall, is secretary.

Additional contracts in connection with [illegible] school building, [illegible] Street, for the Board of Education, have been let as follows: terrazzo floors, Italian Mosaic & Marble Company, Limited, [illegible]; heating regulation, National Regulating Company, New York City, $1,850.

The same firms have been awarded similar contracts in respect of Euclid Avenue school. The contract for heating amounts to $1,070 and for terrazzo floors, [illegible]

The contract for electric wiring of $60,000 school in East Toronto has been awarded to A. R. Rice & Company, Toronto.

Winnipeg, Man.

The contract for the construction of sewer connections and the installation of plumbing to private properties has been awarded by the board of control to Messrs. Pattenden & Fraser, Winnipeg, at $928. Mr. W. P. Brereton, 223 James Avenue, is the city engineer.

Tenders will be received until December 15 by Mr. S. H. Reynolds, 901 Boyd Building, Chairman of Greater Winnipeg Water District, for the drilling of a well at Section 10, Township 10, Range 7 E

Walkerton, Ont.

Plans are in progress for a $5,000 white brick residence, stone and concrete foundation, for Mr. J. B. Hoether, owner and architect.

Business Notes

Ottawa, Ont.

The Ottawa Construction Company are in the market for sand drums and other fittings for improvements to asphalt plant on Catherine Street. The secretary is Mr. John Gleason. Mr. John Foley is the manager.

The largest inland drydock in the United States—possibly in the world—was completed recently at Keokuk, Iowa. It is one of the auxiliary structures that had to be built in connection with the hydro-electric development, which inundated the old Government canal, its locks and drydock. The drydock is 4 3 ft. long, 150 ft. wide at the top and 14 ft. deep. It holds about 7,000,000 gals. of water when the water level in the forebay is at its maximum. Under that condition the filling takes about ten minutes. The main work on the dock consisted in filling in the ground, as the floor of the chamber is 29 feet above the bottom of the river and the top of the embankment forming the forebay on its west side is 19 ft. higher. No pumps are required to empty the chamber—it has been so located and built that it is self draining. On the embankment the Government has erected a machine shop, an administration building, a creosoting plant, timber shed, sawmill, an engine house, a general storehouse, blacksmith shop, paint shop, lock-keeper's house, an ice house, a cold storage house and a storage plant. Railroad tracks run through nearly all of these. The power used in these buildings is generated in a small power station located between the hydro-electric plant and the lock, where two 200 h.p. S. Morgan-Smith turbines drive two Ingersoll Rand air compressors.

More than 18,000 miles of hard surfaced roads were constructed in the United States during 1914, according to a statement by Logan Waller Page, director of the U. S. Office of Public Roads, in an address at the fourth American Road Congress, held in Atlanta, Ga., Nov. 9 to 14. This mileage, he said, is more than three-fourths of the length of the French National road system.

New Companies

"La Compagnie des Granits du Nord, Limitée" has been incorporated with a capital stock of [illegible] to manufacture and deal in granite, marble and other kinds of stone. The principal place of business will be Montreal and the Provisional Directors include Messrs. Joseph Theodule Lafond, Parish of St. [illegible] Lafond, manufacturer, Outremont; and Joseph Lafond, butcher, Montreal.

Soper & McDougall, Limited, have been incorporated with a capital stock of $50,000, and head office at Ottawa, Ont., to carry on business as a general construction company and as general contractors. The provisional directors include Elbert Newson Soper and Norman Gordon Larmouth.

St. Anne's Land Company, Limited, has been incorporated with head office at Montreal and a capital stock of $15,000 to manufacture and generally deal in gas, electricity and water for light, heat and motor power. The incorporators include Messrs. Henry Hutton Scott, Advocate, and Irvin Ernest Woodworth, both of Montreal.

Colonial Mansions, Limited, has been incorporated as a general contracting firm. The capital stock is $40,000, and head office at Toronto. The provisional directors of the company are John Coutts Hay, Russel William Campbell and Ina Maud Johnston.

Goldsmith Products Company, Limited, is a new incorporation for the purpose of manufacturing and dealing in shellac, varnish and other products. The capital of the company is $100,000, and the head office will be situated in Toronto. Messrs. David Heinman Goldsmith and John William Wood, manufacturers; and John Macintosh Duff, solicitor, of Toronto, are amongst the incorporators.

Stein & Reade, Limited, has been incorporated to carry on business as general contractors, mechanical, hydraulic and civil engineers, with head office at Merritton, Ont., and a capital stock of $40,000.

The Canadian Lippard-Stewart Motor Car Company, Limited, has been incorporated to manufacture, buy, sell and deal in motor vehicles and other machines. The capital stock is $50,000 and the head office Ottawa, Ont.

Aztec Oil & Asphalt Refining Company of Canada, Limited, have been incorporated as producers, refiners and dealers in oil, asphalt, tar and other bituminous products. The company has a capital stock of $2,000,000 and the chief place of business will be Montreal. The provisional directors include Frederick Hanry Markey and Waldo Whittier Skinner, of Montreal.

Dominion Foundation Company, Limited, was incorporated recently with head office at Montreal and a capital stock of $50,000 as building contractors. Mr. Matthew Jos. Butler, C.E., and Mr. Hugh Doheny, contractor, both of Montreal, are among the provisional directors.

Palermo, Frascarelli, Panetta, Limited, have been incorporated to carry on business as general contractors. The head office is at Montreal and the capital stock of the company is $50,000. The provisional directors are Rocco Passarelli, Antonio Palermo and Gesidio Panetta, all of Montreal.

The Saskatchewan Mines Development Company, Limited, has been incorporated with head office at Prince Albert, Sask., and a capital of $150,000.

Cements are either natural or artificial. Roman cement is the best-known natural cement in this country. It is made by burning nodules containing some 30 to 45 per cent. of clay, found in the London clay. Portland cement is an artificial compound made by mixing chalk and clay in water in the proportion of about 3 parts of chalk to 1 part of clay. The mixture is then dried and burnt in kilns, the resulting clinker being ground extremely fine. These two cements differ in colour; Portland cement has a greenish-grey colour, and Roman cement has a rich red-brown colour. Roman cement sets very rapidly, due to the presence, in high percentage, of alumina, and is only one-third the strength of Portland cement; it is much weakened by the addition of sand, which should never be used in a greater proportion than 1 to 1.

Concrete highways, 16 ft. in width and totalling 10 miles in length, have been laid in the state of Oregon during the season of 1914. A total of about 4 miles of 8-ft. concrete pavement was also laid. Next year it is planned to lay 15 or 20 miles of 8-ft. concrete pavement, besides the amount of 16-ft. pavement for which funds are found to be available.

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—The Electrical Journals of the United States, Canada and England

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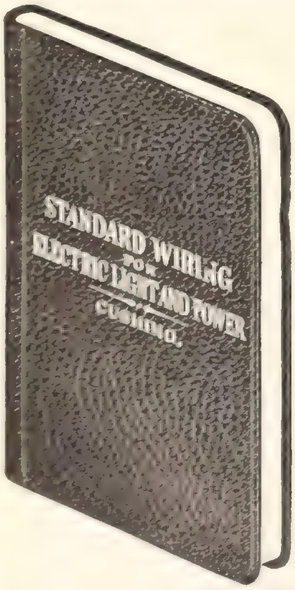

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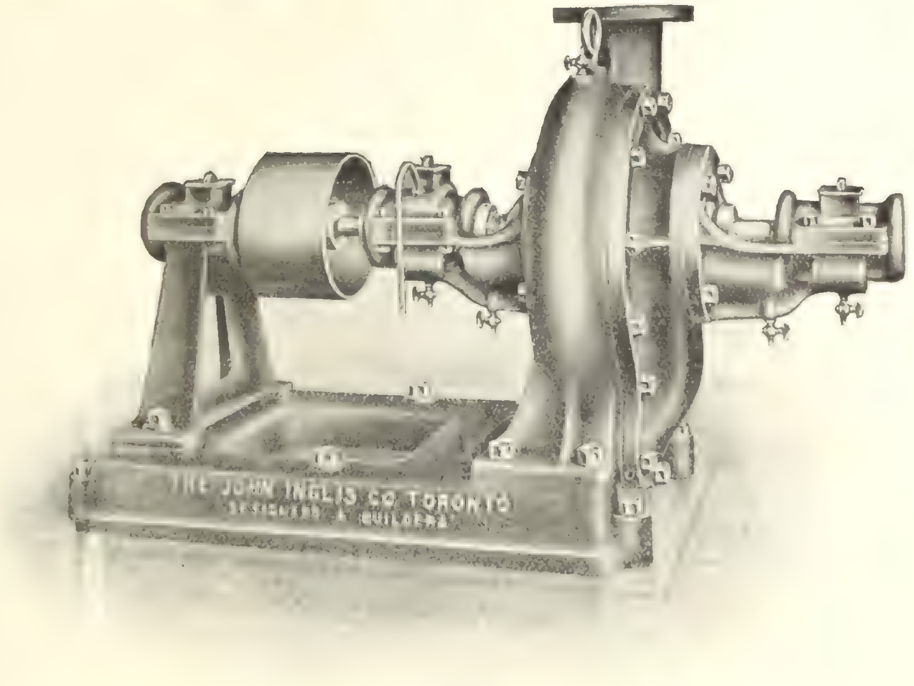
PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—[illegible] to 5 barrel lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, [illegible] $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the [illegible], white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $55 per M. Lots over 100,000, $50.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 66c. per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16 ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6 in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in. $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del. South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 72)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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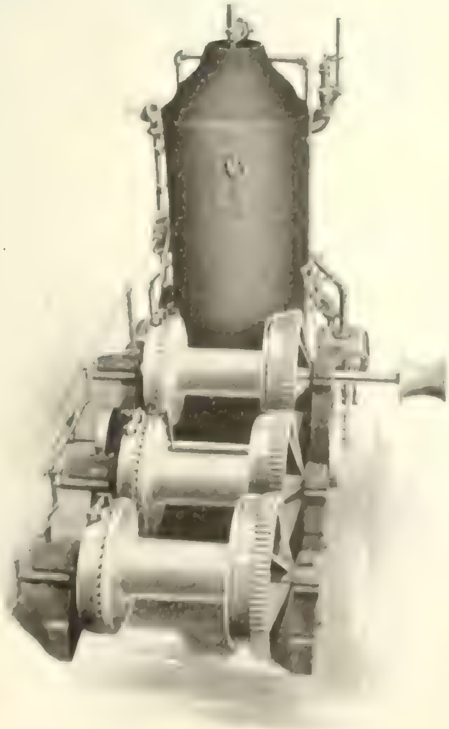

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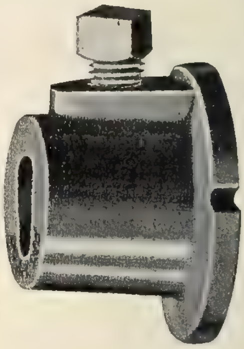

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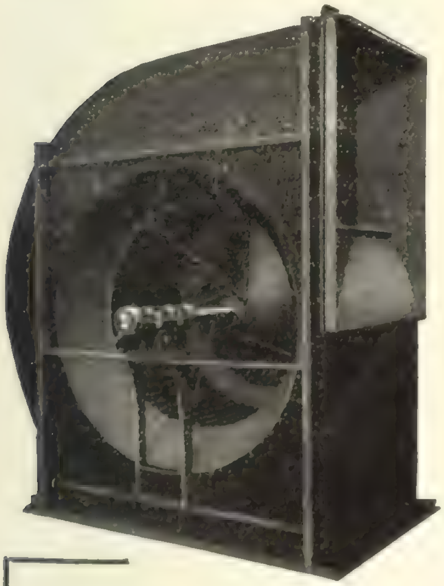

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Agencies in principal Canadian cities

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents, 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $16.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 13c. per ft.; 6-in. 25c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in., 40c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in., $1.50 ft.; 24-in., $2.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 82c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 80c. per gal.; red lead, dry, $8.00 to $9.50 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

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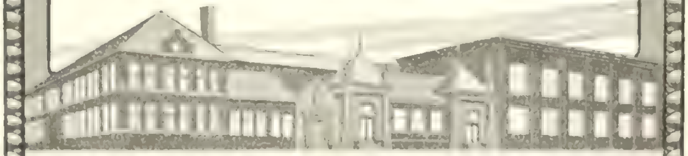

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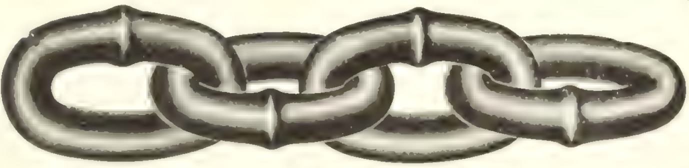

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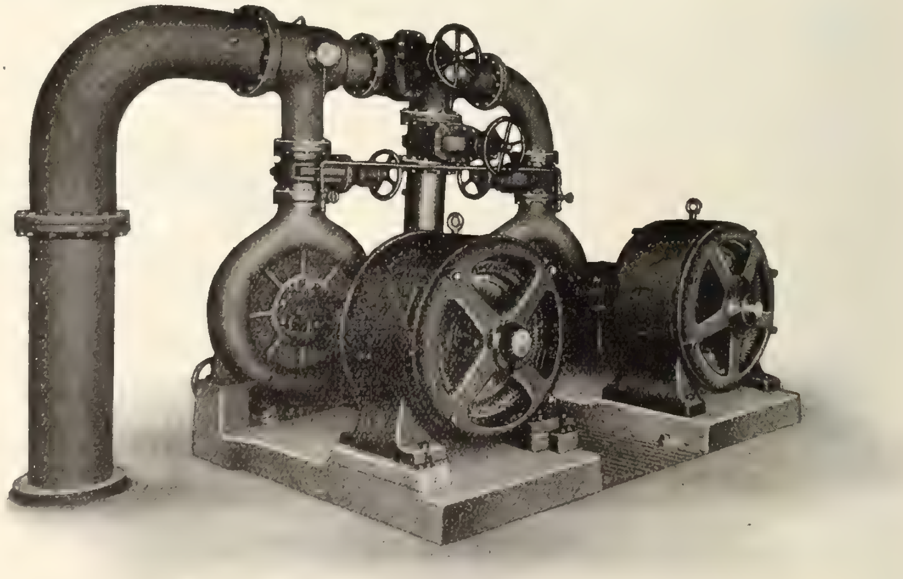

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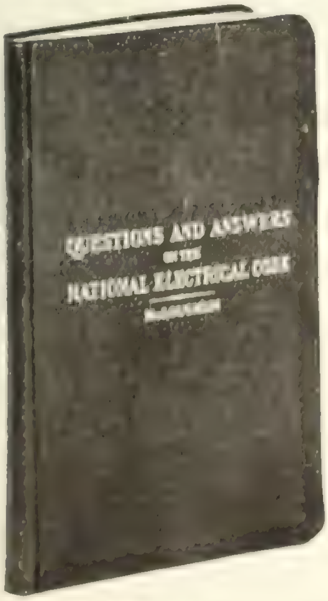

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Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

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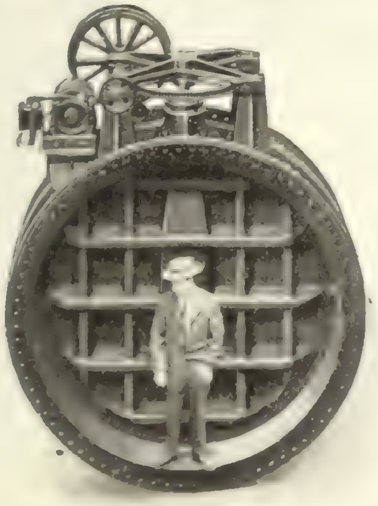

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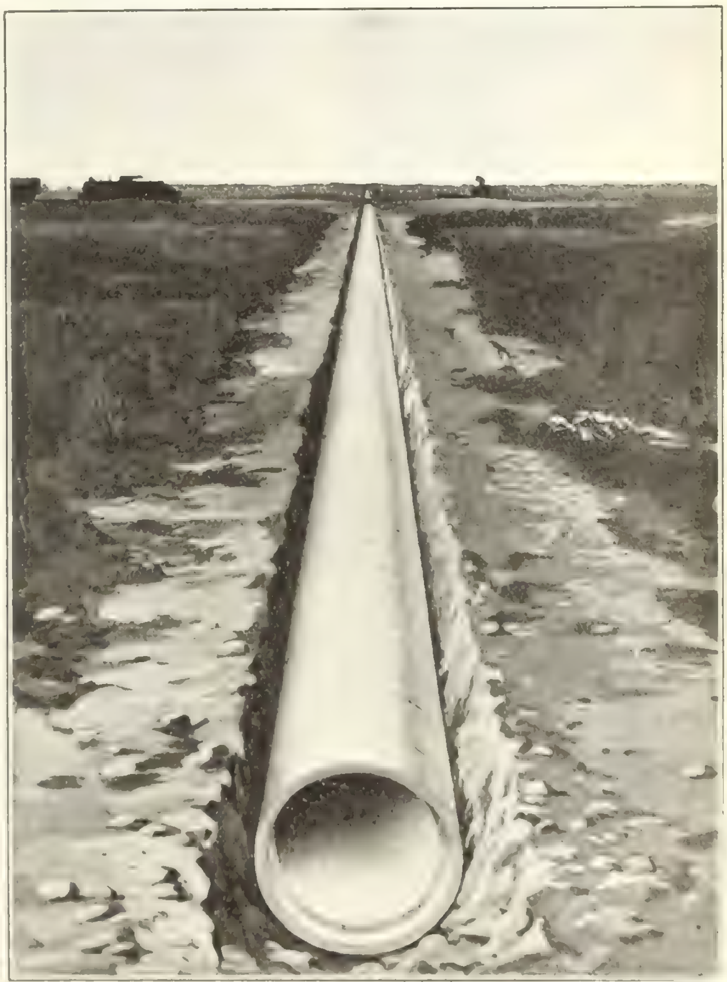

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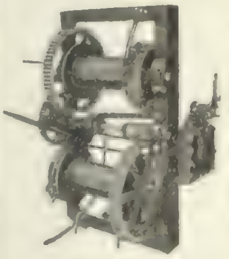
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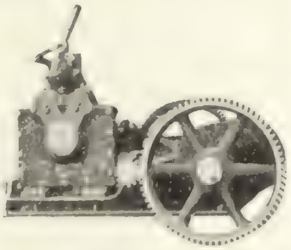
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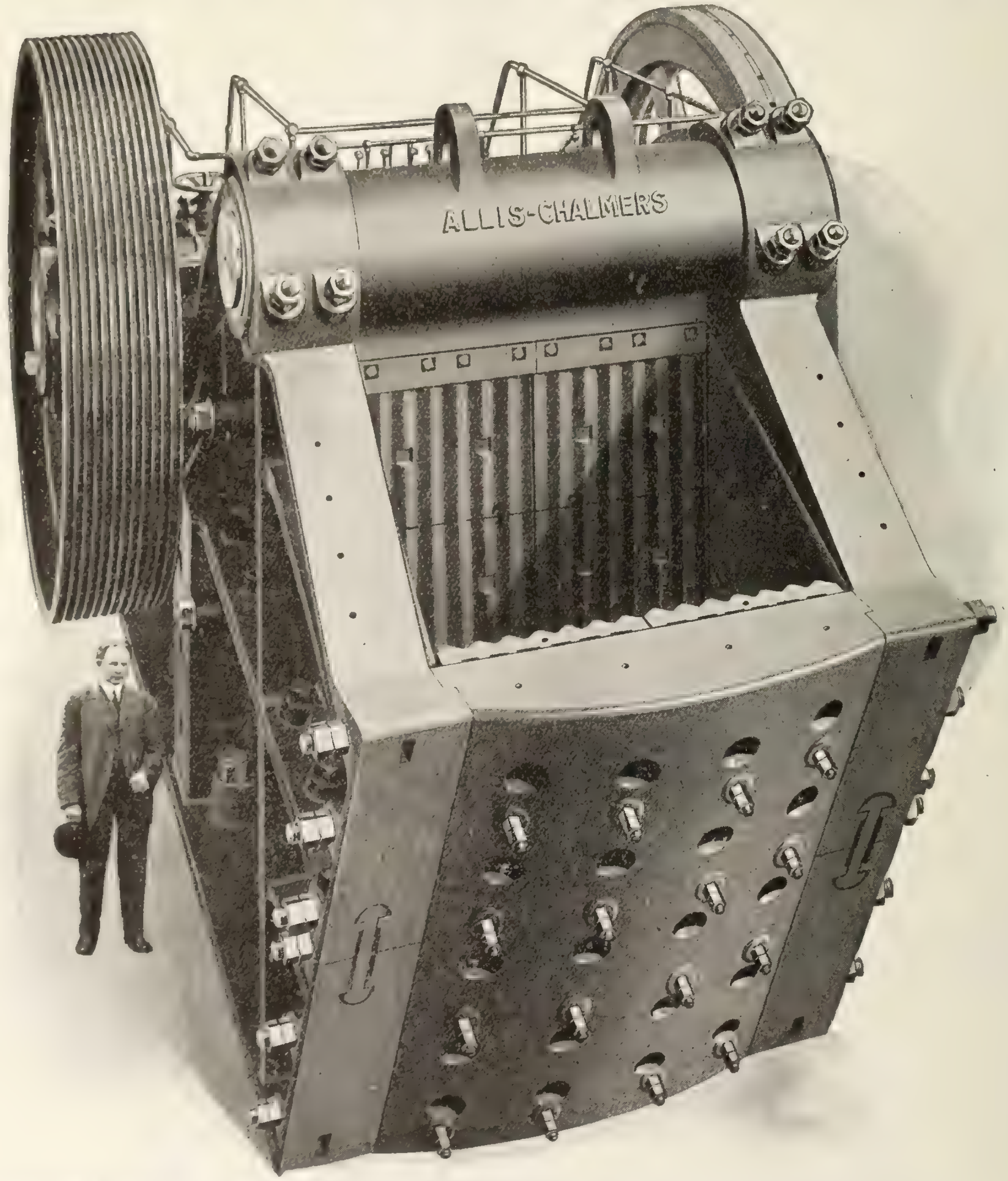

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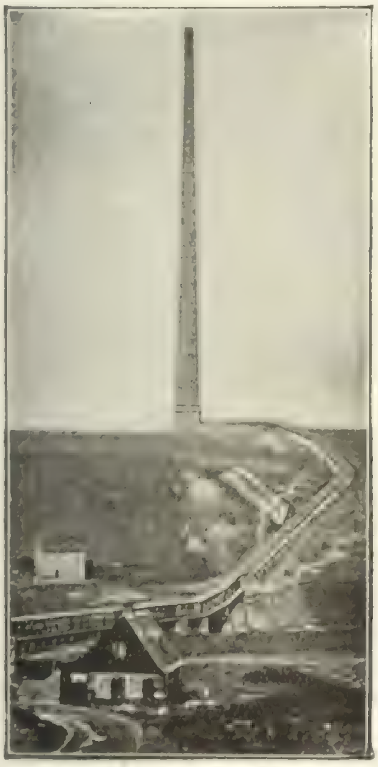

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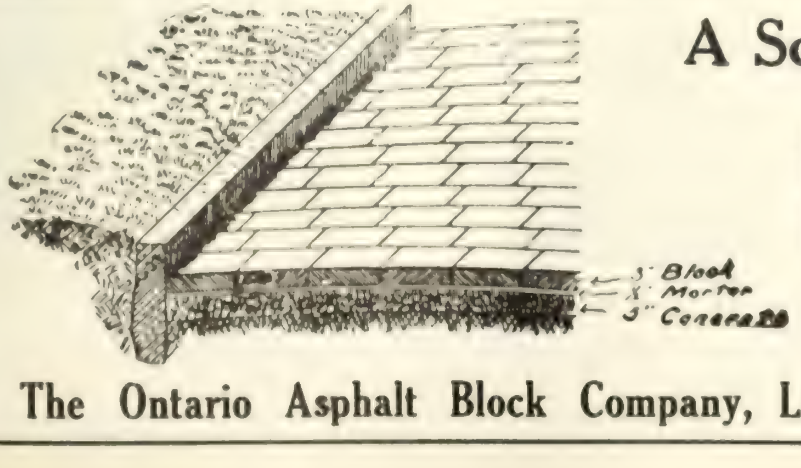

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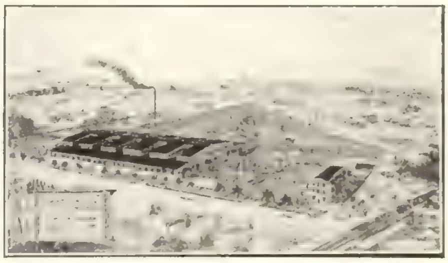

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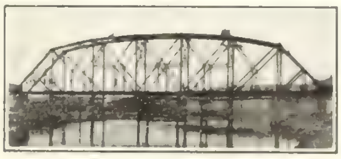

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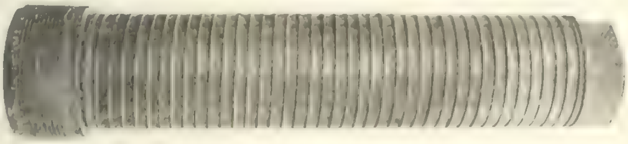

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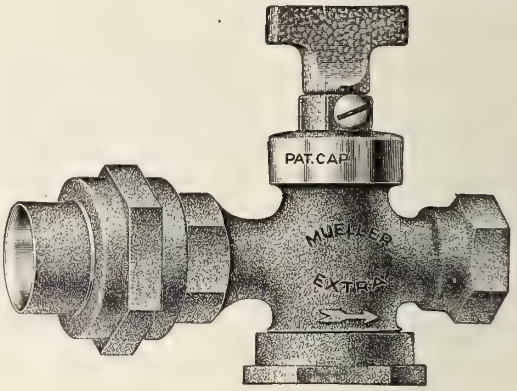

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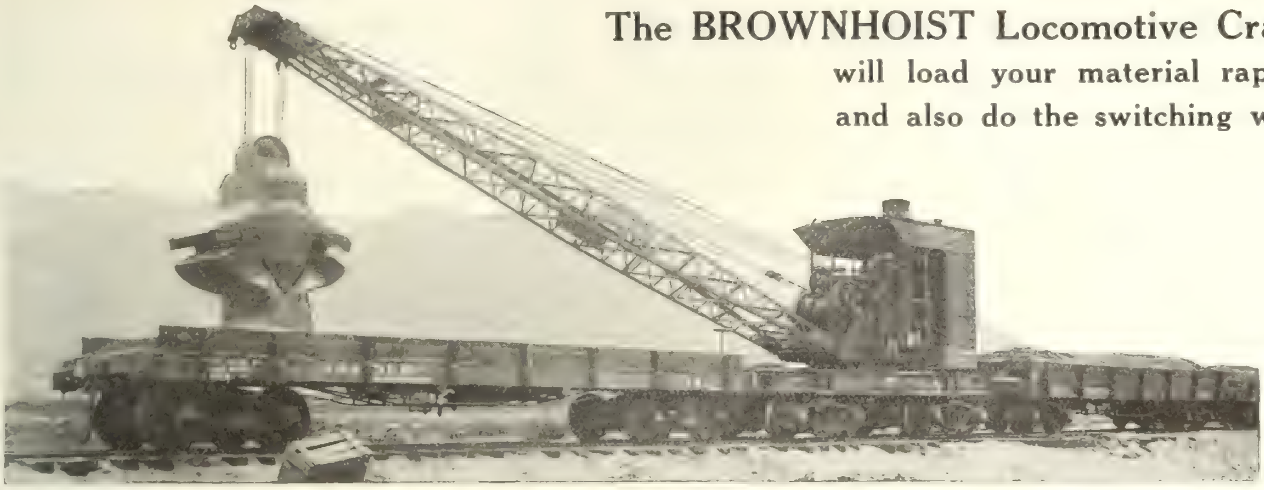

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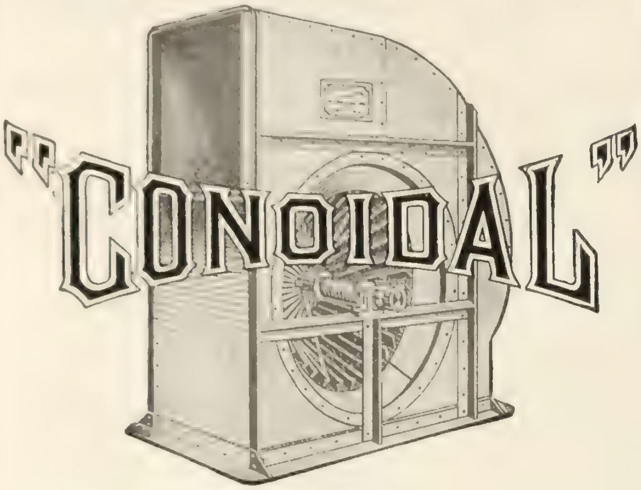

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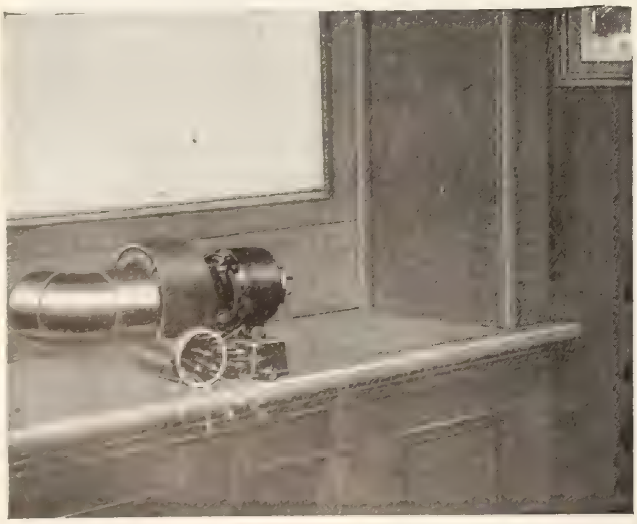

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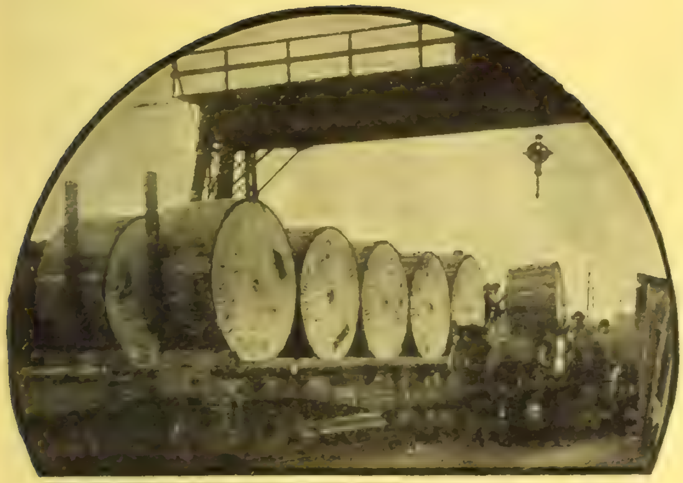

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Power Cables

for this single order.

Big business gravitates to those who can do big things efficiently.

That's why the largest users of wires and cables place their orders with Northern Electric Company, Limited.

One customer requires 17 carloads of Northern Electric Power cable like the one illustrated for their initial installation.

It will pay you to place your orders with the company that has earned the confidence of Central Station men and prominent engineers throughout the whole Dominion.

Northern Electric Company
LIMITED

Montreal	Winnipeg	Edmonton
Halifax	Regina	Vancouver
Toronto	Calgary	Victoria

Warehouse Space To Let
5 Floors of This New Building, For Office and Warehouse Use.
Adelaide St. W., Toronto

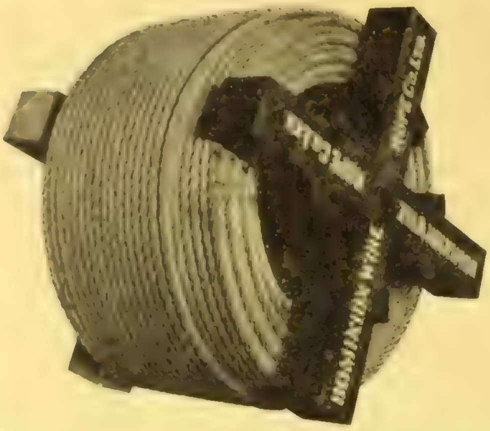
This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally located at Adelaide and Charlotte Streets.
- Light on four sides
- Passenger and freight elevator
- Vaults
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.

For further particulars ask

Hugh C. MacLean, Limited
347 Adelaide St. West, Toronto
Phone Adelaide 2700



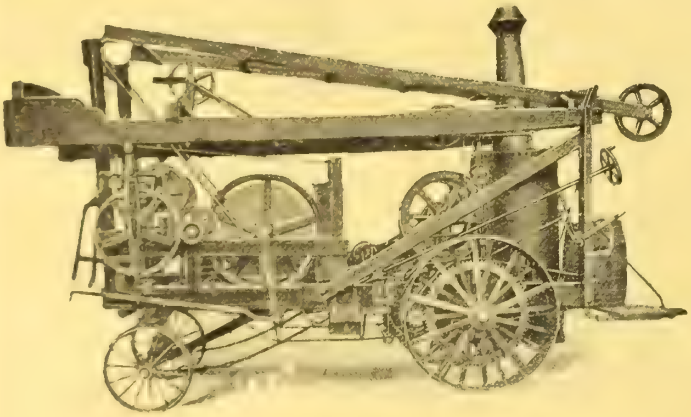
"DOMINION WIRE ROPE"

Suitable for any requirement

We Know Our Ropes are Good—But Our Customers Say They Are The "Best"

Stocks Carried In
Montreal, Winnipeg and St. Catharines

The DOMINION WIRE ROPE CO., Limited, Montreal



Keystone Blast Hole DRILLS

For Contractors — Quarries — Mines

"Keystone" Drills have many advantages over all other makes. It will pay you to investigate the "Keystone" before deciding upon your equipment.

Keystone Blast Hole Drills are supplied in all capacities—with or without Traction

Let us Send you catalogue and full particulars.

"Toledo"
Sheffield

DRILL STEEL

for all classes of rock drilling

Our Drill Steel, manufactured by John Hy. Andrew & Co., of Sheffield, Eng., is a high grade steel, specially prepared for the Canadian market. If you could see the extreme care and experienced attention given in making this steel—you would use no other—as you would then understand the reason why this steel is so satisfactory to all users. We want you to give it a trial.

Full stock carried in our Montreal, St. Catharines and Vancouver Warehouses.

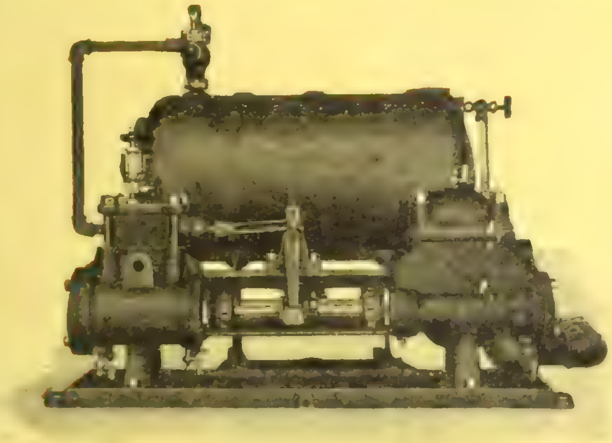
F. H. HOPKINS & CO., HEAD OFFICE MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B. C.

Vol. 28 Toronto, December 16, 1914 No. 50

ESTABLISHED 1886

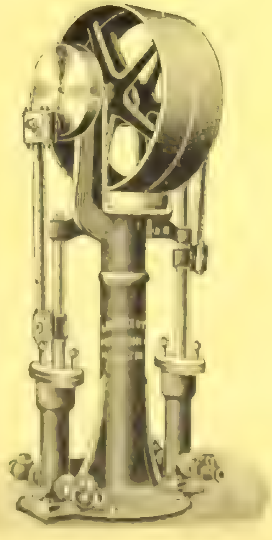
Contract Record and Engineering Review



Smart-Turner Pumps

Made-in-Canada

Before you place your order for anything in pumping machinery, it will pay you to investigate the merits of our product.



The Smart-Turner Machine Co., Ltd.
Hamilton - Canada

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Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

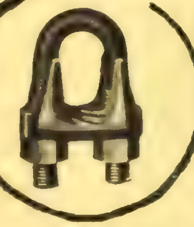
This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson



Here is a Genuine "CROSBY" CLIP

The Genuine Crosby Clip is the Ideal Reinforcement Bar Connection

Part of the Steel work of the Duluth Reservoir

Here is how the "CROSBY" Clip is used to connect reinforcement bars

It has made possible such efficient yet economical reservoirs as those constructed by the city of Duluth, Minn., the state of Illinois at Anna, Ill., and by the Anheuser-Busch Brewing Co., at St. Louis, Mo. Full particulars on request.

The "CROSBY" Clip is drop forged from a special grade of steel—galvanized to prevent rust. It has tremendous gripping power. Once tightened, it will not pull out, break out, nor rust out.

MANUFACTURED BY

AMERICAN HOIST & DERRICK CO.

St. Paul, Minn., U. S. A.

SOLD BY: General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot, Ltd., Vancouver, B. C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta. Mussens Limited, Montreal, Que. Dominion Wire Rope Co., Montreal, Que.

28 "Service" Branches
Throughout Canada

Canadian Consolidated
Rubber Company, Limited
Montreal, P. Q.

A New Year's Resolution For You

"RESOLVED that, during 1915 and thereafter I will give preference, in my purchases of rubber goods and all other material, to such as are made in Canada."

So far as rubber goods are concerned you run no risk in making this patriotic resolution, as we manufacture a complete line and the price, quality and style are right.

When in the market for tires, hose, belting, packing, etc., let us show you what we can do.

It is our desire to serve you.

Canadian Consolidated
Rubber Company, Limited
Montreal, P. Q.

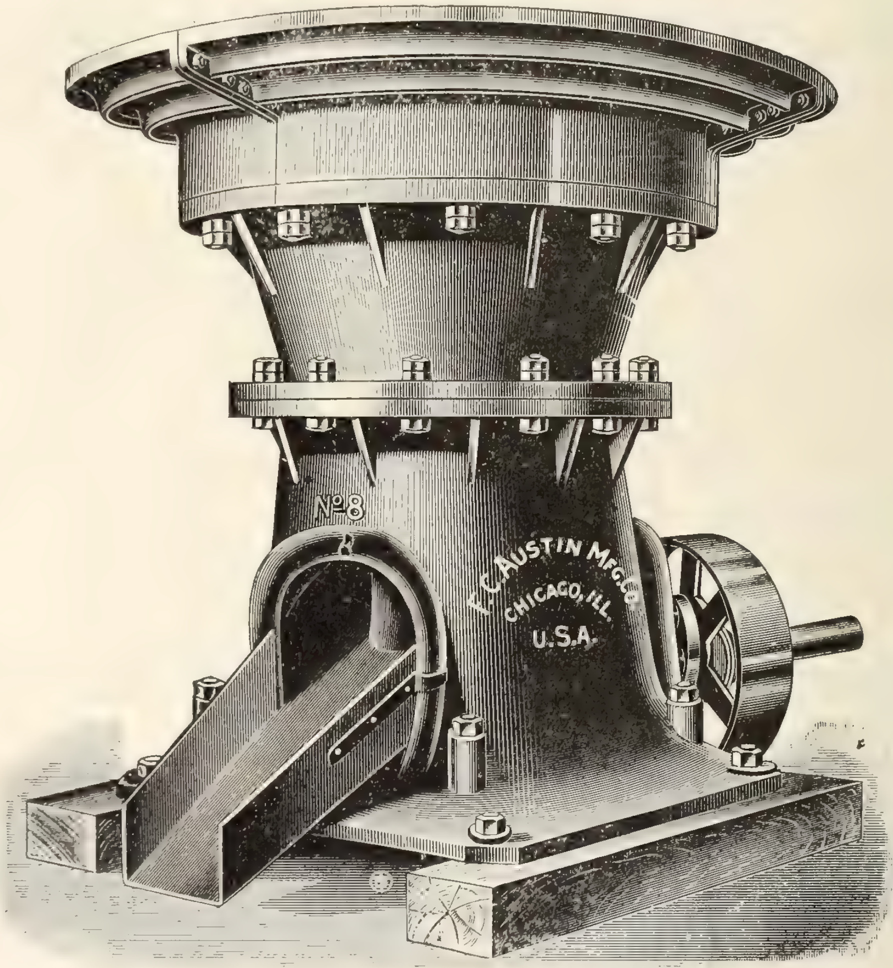
28 "Service" Branches
Throughout Canada

The World's Leading

ROCK and ORE CRUSHER—The

Austin Gyratory Crusher

Made
in
Eight
Sizes


No 8
F. C. AUSTIN MFG. CO.
CHICAGO, ILL.
U.S.A.

Capac-
ities
50 to
5000
Tons
per day

Its many superior qualities and mechanical advantages have won the highest reputation amongst quarrymen and mining engineers.

Plans and specifications furnished for any size of plant.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

The Reasons Why?

You Should Have

Austin Dump Wagons

On Your Job

They have the shortest wheel base of any wagon which means lightness of draft and strength of construction.

They are the lowest wagon.

They carry their load close to the axle and to the power.

Though low and short, they have the greatest clearance beneath them.

Austin Wagons have the bottom boards attached by chains, thereby allowing the doors to swing loosely in any and every direction. They raise automatically up the outside of the wagon boxes. This prevents the wagons being stalled on the dump. The ends of the boxes are practically perpendicular, ensuring a complete, clean and rapid discharge.

Catalogue on request.

Mussens Limited

MONTREAL, 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

CLASSIFIED INDEX TO ADVERTISEMENTS

The following regulations apply to all advertisers:—Eighth page, two headings; quarter page, four headings; half page, eight headings; full page, sixteen headings.

Armature Steel
Hull Iron & Steel Foundries

Air Compressors
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Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

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Architects' Instruments
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Aikenhead Architectural Iron Works
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Canadian Sirocco Company
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Boving Company of Canada
Inglis Company, John
Jenckes Machine Company
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Marsh & Henthorn
[illegible] Iron Wks.
Mussens Limited
Rock & Power Machinery

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[illegible] & [illegible] Brick Co.
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Wadsworth Howland Co.

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Sheldons Limited

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Sheldons Limited
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Dickson Bridge Works
Dominion Bridge Company
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Sarnia Bridge Company
Structural Steel Company
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Woodhouse Chain Works

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Badger Concrete Mixer Co.
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Wells & Gray

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Conduits Co., Ltd.
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
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Sarnia Metal Products Company

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Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

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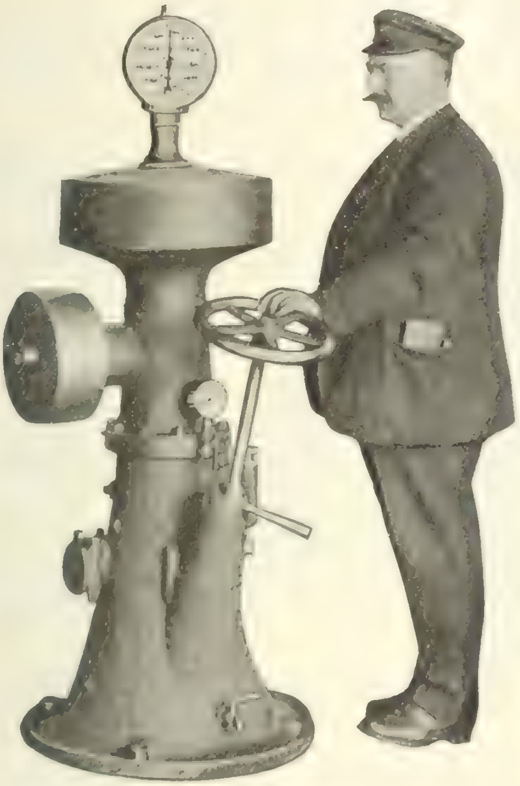

MADE IN

CANADA

Water Turbines
Centrifugal Pumps

*Patronize Home Industry and let
us Quote on Your Requirements*

Boving & Co. of Canada
Limited

94 Grafton Ave
Moose Jaw, Sask.

Head Office
164 Bay St.
TORONTO

London Bldgs.
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A Canopy, a Business-Getter

Experience has proved that a canopy over a store window is one of the best business-getting agents that can be employed. It also adds to the value of the building and enhances its appearance. Erect

A Luxfer Canopy

on the stores or buildings that you are planning. We will submit designs or follow your design.

Luxfer Prism Co.
Limited
100 King Street West, Toronto

TOOL ROOM PARTITIONS

Machinery Guards

Window Guards

and

Wire Work of Every Description

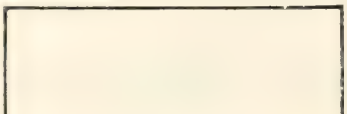
Wire Rope

Rope Fittings

Manufactured by

The B. Greening Wire Company, Limited

HAMILTON, ONT. MONTREAL, QUE.



Raising the Hoist.

MORRIS TELESCOPIC ASH - HOIST.

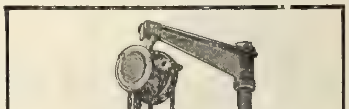
SAFETY All hoists tested with a load-and-a-half.
SPEED The load is lifted at 30 feet a minute.
EASE All gears machine cut and accurate.
SNUG Occupies little space when not in use.
STOCK We stock complete hoists and spare parts

The Morris Telescopic Basement Hoist is used for lowering coal, barrels, ice, trunks, cases, etc., into the cellar of hotels, schools and public buildings, and for the removal of ash-cans and garbage-cans. It enables one man to do safely and comfortably what formerly was a risky and heavy task for two. The separate lifting gear can also be used for many other purposes around the building. The Jib-Head swings round to deposit its load right on the sidewalk.

When not in use all parts are below the sidewalk level, free from interference and causing no obstruction.

MADE IN CANADA

It appeals to the Architect as a complete solution of the problem, to the Owner as a stock article, reasonable in price and a labor saver, to the Janitor as a quick way through many a rough job.



Lifting the Ash-can.

THE HERBERT MORRIS CRANE & HOIST COMPANY, LIMITED,

EMPRESS WORKS, PETER STREET, **TORONTO.** Write for name of Local Agent. BRANCH OFFICE CORISTINE BUILDING, **MONTREAL.**

For Permanent Lines:

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30" Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices:—BURLINGTON, NEW JERSEY

Sales Offices: Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh, St. Louis, San Francisco

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SAFETY FIRST

FOR CONDUIT

Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

Orpen Conduit Company, Limited

TORONTO, ONT. MONTREAL, QUE.

Pilkington's Window Glass

P.B. BRITISH CANADIAN GLASS

The Brand of Quality

BRITISH POLISHED PLATE IN ALL SIZES

All descriptions of Window Glass may be obtained from our warehouses named below.

WIRED GLASS—The well known fire retardant. Made in three kinds: polished, ribbed and cast.
PRISMATIC—Ornamental, figured, rolled, etc.
WINDOW GLASS—For Buildings, Car and Horticultural purposes.

SPECIAL—We strongly recommend a trial of our 3rds quality window glass.

PILKINGTON BROS. LIMITED

WORKS: ST. HELEN'S, LANCASHIRE, ENGLAND——THOROLD, ONTARIO, CANADA
WAREHOUSES: MONTREAL TORONTO WINNIPEG CALGARY VANCOUVER

HERRINGBONE COPPER ALLOY LATH

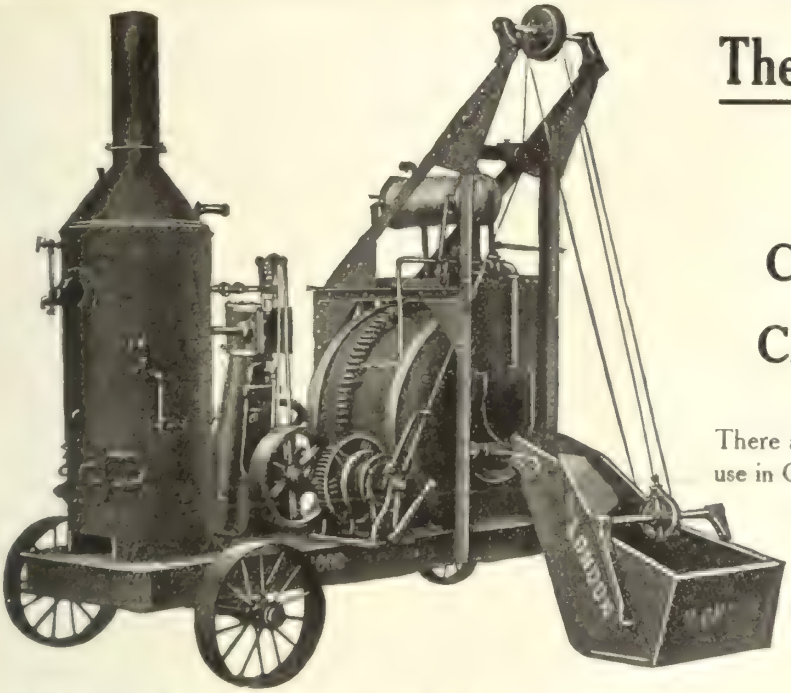
Lime in Hard Wall Plaster

The series of tests which led to the determination that all Herringbone Lath should hereafter be made from copper alloy showed also that there was a wide variation in the rate of corrosion of the different brands of hard wall plaster. When these plasters were arranged in a table in the order of their corrosiveness, the most vigorous at the top, it was found that they were also arranged inversely in the order indicated by their content of hydrated lime, the plaster containing the least lime at the bottom.

That hydrated lime in hard wall plaster retards the corrosion of metal lath cannot be doubted. Fifteen tests on plain steel with a plaster containing no lime showed an average rate of corrosion four and a quarter times as great as that shown by a plaster containing seven per cent. lime. On copper alloy the rates of corrosion were both smaller and the effect of the lime was further increased. The combination of copper alloy and a plaster containing seven per cent. lime showed a rate of corrosion only one-fifteenth as great as that shown by plain steel with unmixed hard wall plaster.

Ask for the booklet "Why Copper Alloy?"

Clarence W. Noble - General Sales Agent
117 Sun Life Building, Toronto
Metal Shingle & Siding Company, Montreal



The London Concrete Mixer

Made in
CANADA
By
CANADIAN LABOUR
With
CANADIAN CAPITAL

"Business as usual."

There are more than twelve hundred London mixers in use in Canada—also many in foreign lands. All steel construction and built like a battleship. London Concrete mixers are made in twenty-three sizes and fitted with any equipment.

SUPPORT HOME INDUSTRIES.

We are the Largest Manufacturers of Concrete Machinery in Canada

THE LONDON CONCRETE MACHINERY CO., LTD.

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CONTRACTORS' LOCOMOTIVES

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years' experience as builders. Duplicate parts carried in stock for immediate shipment. Engines built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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[illegible] Limited
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Manitoba Bridge & Iron Works
Sheldons Limited

Dump Carts and Wagons
Deere Plow Co., John

Drying Apparatus
Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
Gent & Company

Electric Steel Castings
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Turnbull Elevator Co.

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American Enamelled Brick & Tile Company

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Canadian Equipment Co.
Hopkins & Co., F. H.

Exhaust Heads
Canadian Buffalo Forge Co.
Sheldons Limited

Engines
Boving Company of Canada
Canadian Buffalo Forge Co.
Canadian Sirocco Company
Hopkins & Co., F. H.
Inglis Company, John
Jenckes Machine Company
Laurie & Lamb
McDougall Caledonian Iron Wks.
Mussens Limited
Rock & Power Machinery

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Bowman & Connor
Cape Company, E. G. M.
Chipman & Power
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
Lea & Ferguson
Mitchell, C. H.
McDougall, Geo. K.
Pullar, H. B.
Tyrrell, H. G.

Expanded Metal
Pedlar People Limited
Trussed Concrete Steel Co.

Fans
Canadian Sirocco Company
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.

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Filtration Plants
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Feather & Roadhouse
Hope & Sons, Henry
Mussens Limited
Pedlar People Limited
Steel & Radiation Limited
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Lecky & Collis

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Canadian Sirocco Company

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Boving Company of Canada
Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
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Canadian Allis-Chalmers, Ltd.
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Jenckes Machine Co.
Lecky & Collis
Marsh & Henthorn
Morris Hoist & Crane Co., Herbert
Mussens Limited
Rock and Power Machinery
Royce Limited

(Continued on Page 14)

"With Compound Gear and Brake Attachment"

For hoisting or lowering ash cans, kegs, barrels, cakes of ice, etc., between cellar and sidewalk, there is no known contrivance that will do the work so economically, so speedily, so safely, as

The G. & G. Telescopic Hoist

(PATENTED)

¶ When not in use, no part shows above sidewalk.

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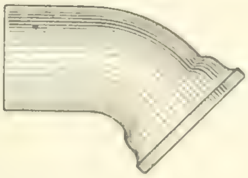

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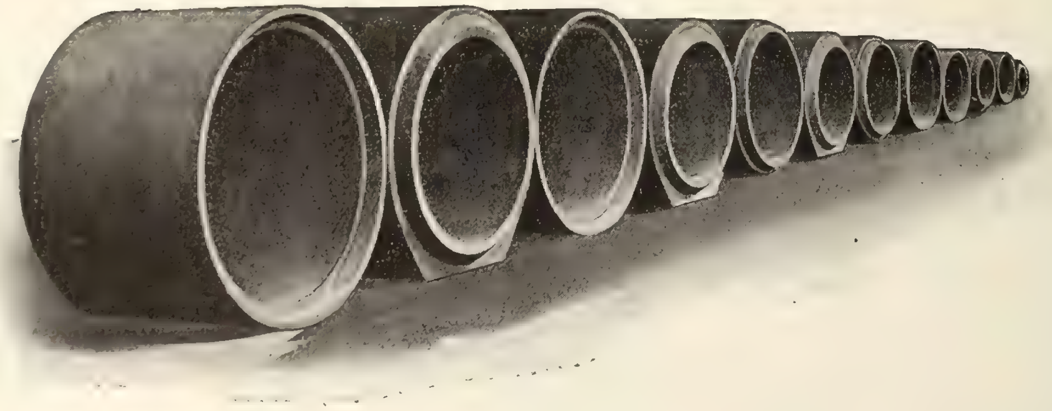

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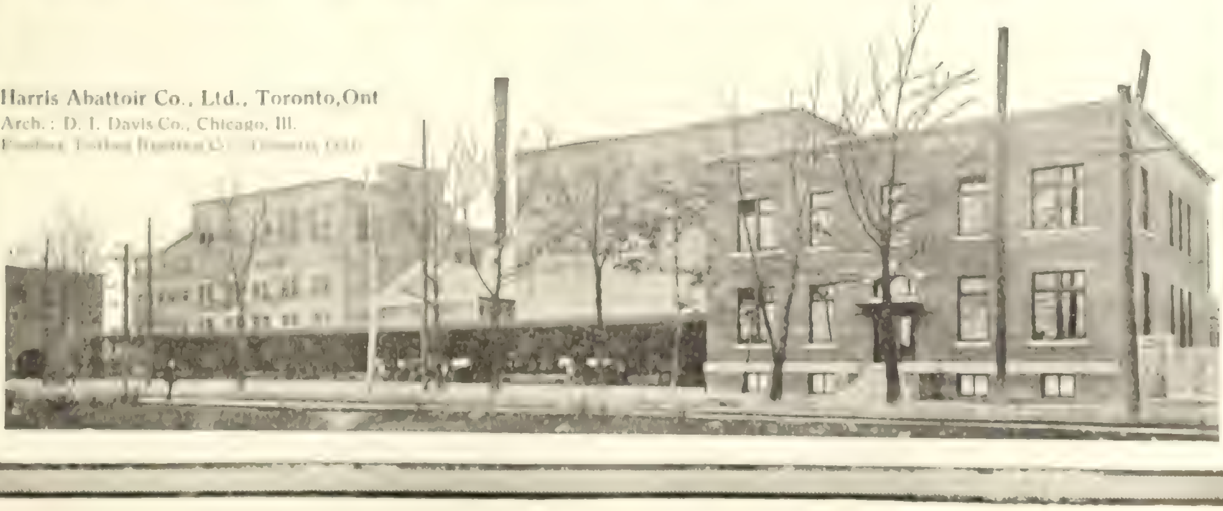

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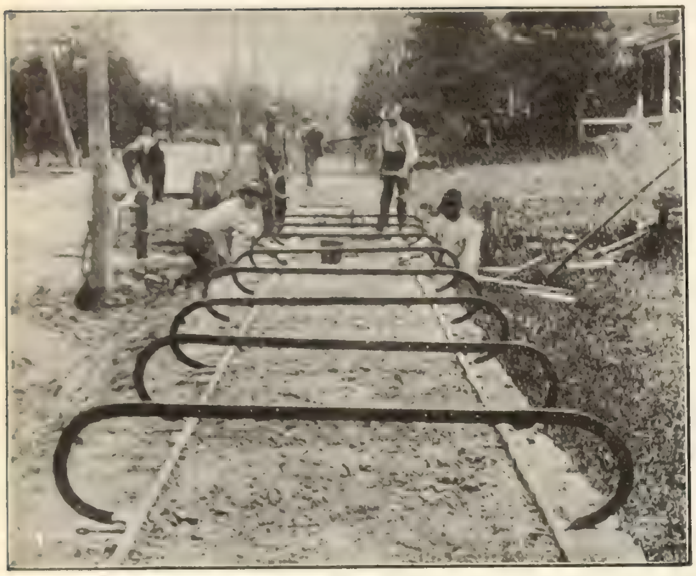

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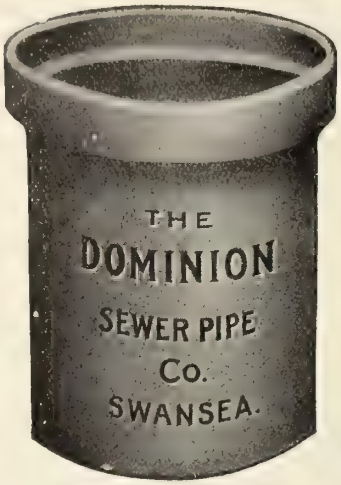

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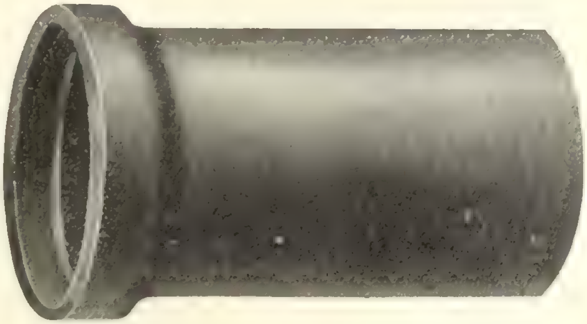

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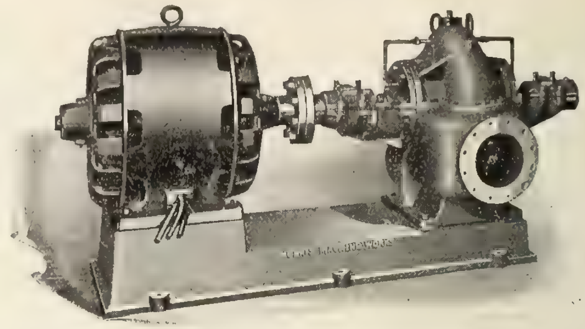

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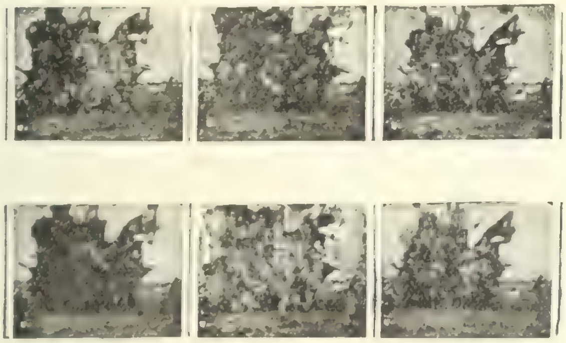

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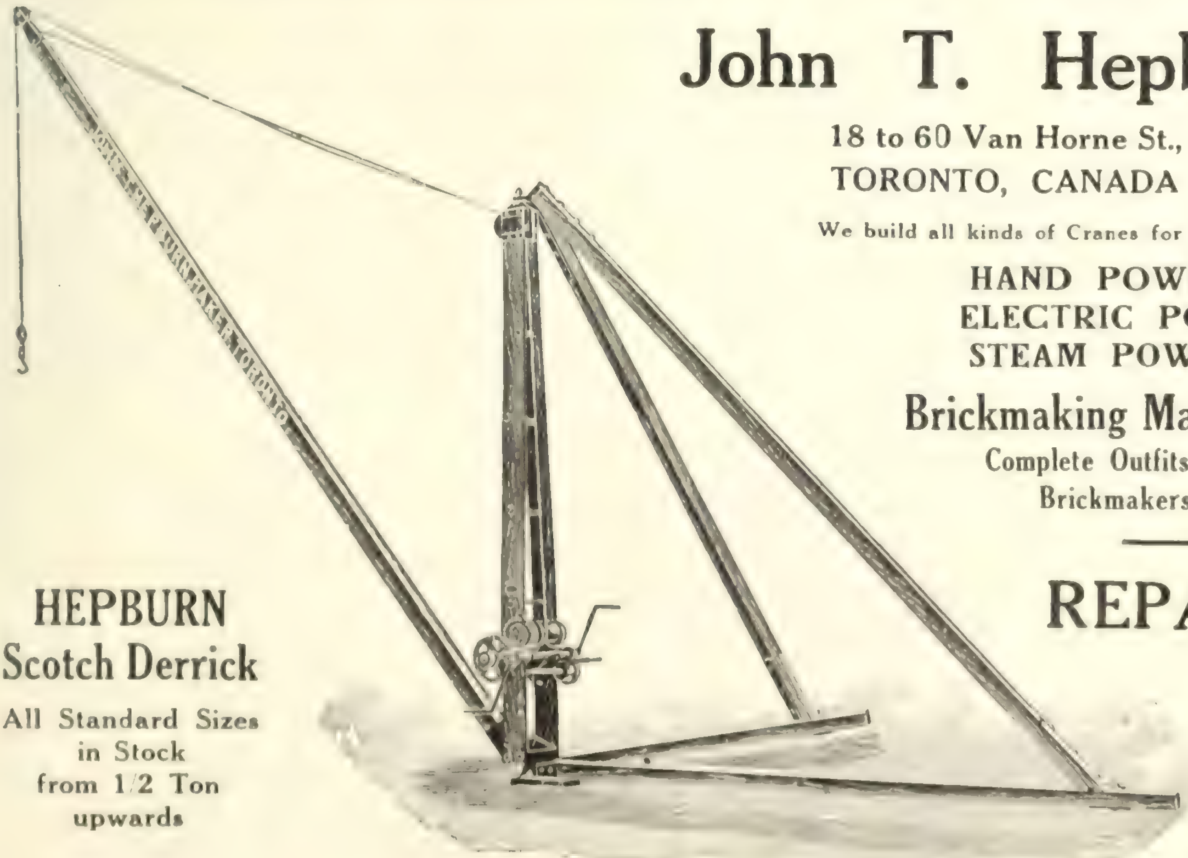
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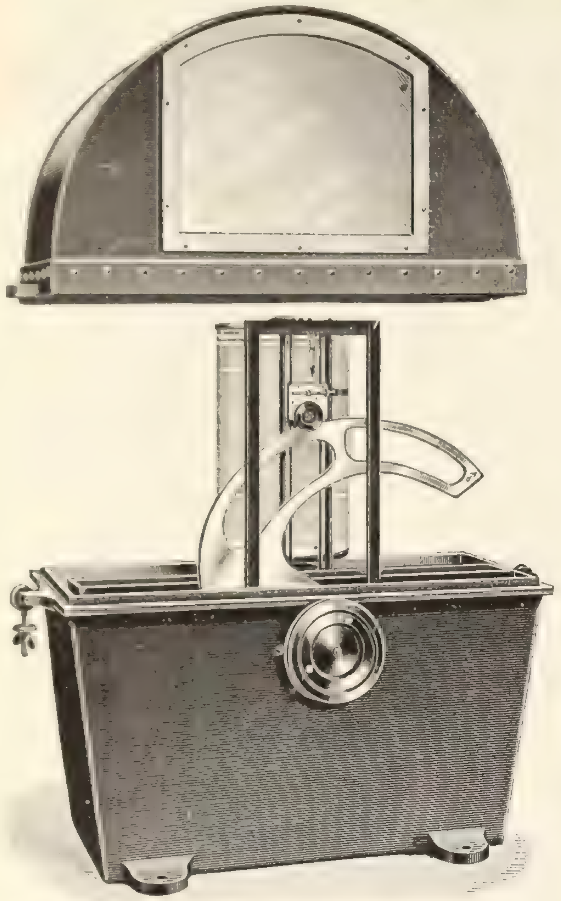

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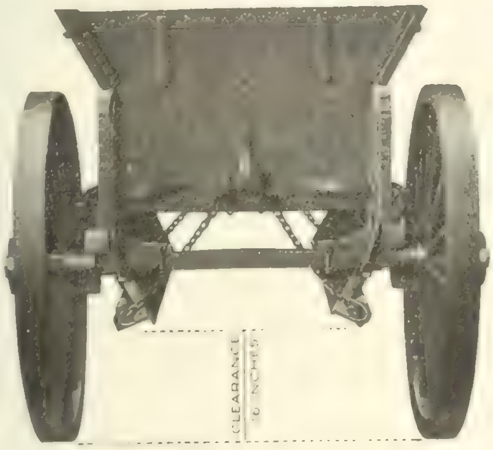

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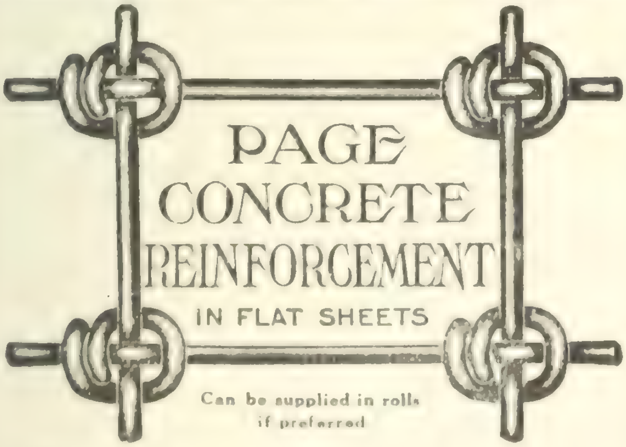

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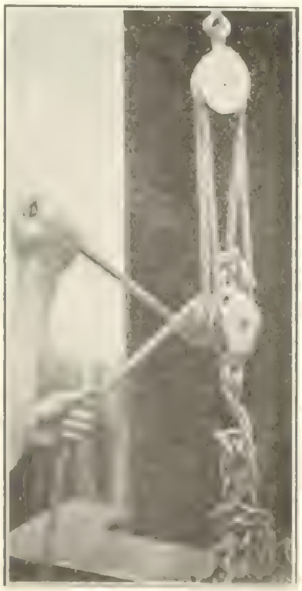

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ESTABLISHED 1886

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The Toronto Technical School

Of the many descriptive building articles which have been published in the Contract Record during 1914, none has been of more general interest than that relating to the Central Technical School, Toronto, published in this issue. The article is devoted primarily to features of design and construction, and so, naturally, it is of particular interest to the constructor, but there are outstanding facts which concern the layman and all identified with municipal and other governing bodies.

The general aspect of this undertaking is not discussed in the article and so it is fitting to make passing mention of it editorially.

In this magnificent building, erected at a cost of some $2,000,000, Toronto has a standing monument to progressiveness and material proof of an understanding of present-day requirements. The example is one which may well be followed, particularly in Western Canada, where the facilities for technical education are so lamentably few. At this very time, when business conditions are quiet, funds hard to obtain, and building work slackening, an impetus to the activities of many a community throughout the country might be given by the technical school movement. The erection of a building on the Toronto scale would not have to be considered in many cases and in some instances the expenditure might even be reduced by a couple of ciphers. Funds may be scarce, but money is always obtainable for sound legitimate projects that have substantial backing, and contracts for such buildings could not be awarded at a better time than the present. The employment which these undertakings would provide for the working classes would be a Godsend to the country, and the advantages accruing would be far more general than in the case of such work as road construction, where the skilled mechanic is either out of it or has to join the unskilled ranks to earn a living. The monument which Toronto is raising is a permanent appeal to the country.

Municipal, county and provincial bodies are united at the present time in opposing unnecessary expenditure—and rightly so, but it is not sufficient to be united in works of **omission** at such a time as this. The country's present need is for works of **commission**. In all the years of Canada's ascendancy the constructional interests have helped the country, and they have a right to expect some consideration at the hands of the country during a period of temporary decline.

In this there is no weak-kneed plea for charitable offerings; there is a straight, independent, unequivocal contention that the approaching completion of the Toronto Technical School suggests a line of activity which would benefit every man identified with constructional work, benefit the public, benefit the country and benefit the Empire. If it were known throughout Great Britain, and Australia, and India—in fact all over the world, that Canada had pioneered and financed an active policy of educational improvement—something on a scale sufficiently large to attract attention—the effort would be repaid a thousand-fold.

The chronic objector who condemns at sight everything that recalls the dollar sign will say that the schemes could not be financed in the first place and that the buildings could not be manned and equipped in the second. In both cases he is absolutely wrong. The combined governments of Canada, united in such a purpose, could find millions as easily as thousands. And by the time the buildings were completed—and long before, the country would have experienced a revival second to none in her history. We have the men we have the money, we have the ships, and—which is greater than all—we have supreme confidence in the Empire. After Great Britain and her allies have reduced Germany to the national size of Montenegro there will be a flood of immigration to Canada which will revolutionize the country's business. The people of Canada have great opportunities and this is one of them.

The general aspect, then, of the new technical school at Toronto is by no means subsidiary to that which deals with features of design and construction, interesting though the latter may be. A study of the floor plans reveals a skilled layout, which cannot fail to be suggestive to those who have to do with future projects of this kind. The architectural symmetry of the structure, the materials employed, the accessibility of the building, the facilities provided, the mechanical installation—all these things will repay the constructional man if he goes into them in detail. But apart from this, and above all this, there is the feature of **example** which the country should not overlook.

Dominion Charters Upheld by Privy Council

THE recent decision of the Privy Council in the case of the John Deere Plow Company v. Duck, and Wharton v. The John Deere Plow Company, clears up, to a very great extent, a number of uncertainties which have surrounded the matter of Dominion and Provincial Companies' licenses ever since Confederation. The chief result of the decision is the establishing of the paramount jurisdiction of the Dominion over trade and commerce, making it definitely clear that a company which has secured a Dominion charter may carry on business in the various provinces of Canada without the necessity of taking out anything in the form of a Provincial charter. Manufacturers and other commercial companies operating in Canada who are well advised, will, as a result, henceforth take out Dominion charters and ignore Provincial licensing acts. In order to understand the situation clearly, it is necessary to refer briefly to the cases upon which judgment has been given by the Privy Council.

The John Deere Plow Company was incorporated under a Dominion charter, with head office in Winnipeg, and authorized to carry on business in agricultural implements throughout Canada. The case of the Company v. Duck was an action for breach of contract to accept delivery of certain implements which Duck had ordered, but afterwards refused to take, alleging that the Company, having no license in British Columbia, could not proceed against him. The Company claimed that its Dominion charter was all that was necessary to enable it to carry on business in any province. The case of Wharton was a friendly action asking for injunction to restrain the Company from carrying on business in British Columbia, on the ground that such business would be illegal because the Company had no Provincial license. Both cases were tried in the Supreme Court of British Columbia and decided against the Company. Appeal was then taken to the Privy Council.

The judgment is very sweeping and declares that the clauses of the British Columbia Act under consideration are invalid because they interfere with the powers conferred on the Company by the Dominion Parliament, and with the Company's status in the Courts. The judgment applies equally to the extra-Provincial licensing and registration acts in Ontario, Manitoba, Alberta, Saskatchewan, New Brunswick, Nova Scotia and the Yukon. The Act of the Province of Quebec specifically excepts Dominion companies, and is, therefore, unaffected. The Act of Prince Edward Island is of a different character, and is also unaffected.

Briefly, therefore, the situation is as follows:—

To do business throughout Canada a Dominion charter alone is necessary.

A Provincial license enables a company to do business in the province from which the license is obtained. Whether a Provincial license enables a company to do business outside of the province issuing the license, is still unsettled, and is under consideration in connection with a case shortly to come before the Privy Council.

A province can no longer compel a company with a Dominion charter to obtain a Provincial license or to be registered in the province as conditions of exercising its powers or of suing in the Courts.

The rights of the provinces to enact laws affecting the general public in the provinces and relating to civil rights, or taxation, or administration of justice are not affected.

The opinion of the Privy Council is definitely ascerted in the following references to the provisions of the British Columbia Companies' act which were under discussion:—"Their Lordships think the legislation in question really strikes at the capacities which are natural and logical consequences of incorporation by the Dominion Government of companies with other than Provincial objects."

The Part of the Engineer in the Community

IN his Presidential Address, delivered on December 3rd, before the Regina Engineering Society, Mr. L. A. Thornton (City Commissioner), insisted that engineers should pay more attention to the draughting of legislation than they were doing. He contended that they should have more to say in regard to the manner of expending money on public improvements. Mr. Thornton referred particularly to the large amount of money that had been lent to Canada by the Old Country, and showed how most of this money had been spent upon constructional work which had come under the practical supervision of engineers.

Tracing the history of the city through all its changes, the speaker pointed out how such a history constituted the history of the race which inhabited the city and the surrounding country. In the history of civilization, Babylon was one of the earliest municipalities.

Continuing to the point of making mention of certain Grecian and Roman cities, Mr. Thornton came down to the city of to-day, and discussed the part of the engineer in its activities. Engineers were interested in practical work, and legislation of many kinds might be traced to their influence.

New York City's debt was one-third of the total debt of the United States Government, and more than one-fourth of it had been incurred upon improvements.

Mr. Thornton discussed the commission form of government, and while commending it, qualified his commendation by showing its dependence upon personality.

The speaker suggested that future meetings of the society should take up for discussion such important questions as systems of taxation and forms of government.

The Central Technical School, Toronto, upon the completion of the exterior.

The Design and Construction of the Central Technical School, Toronto

(Staff Article)

THE new Central Technical School at Toronto, which is now well advanced towards completion, contains features of outstanding interest in regard to design and construction.

The site is practically level and takes up two entire city blocks, measuring 813 ft. x 300 ft. The building itself measures 425 ft. x 212 ft. It occupies the centre of the site, the main elevation facing west on Lippincott street. The rear elevation overlooks Borden street; the north, Lennox street; and the south, Harbord street. To those acquainted with the city plan of Toronto, the accessibility of the building from the street car lines will be apparent.

Building operations were commenced on May 1st, 1913. Progress in the interval has been so marked that it is fully anticipated that the work will be completed in the allotted time, that is to say, by next May.

The excavation for the sub-basement was quite an undertaking in itself. The building is set on extremely hard clay. Below the basement floor this clay became so hard that dynamite had to be used. Practically no water was met with in the excavation. The structure is resting on a hard, compact and dry foundation.

Concrete work was started about July, 1913, and most of the foundation walls were in before the arrival of the extremely cold weather. During December the main walls had been brought well above grade, but owing to the severe frost the brick work had to be stopped for a period of about three months. Operations were renewed at the end of March, 1914, when the steel work was got under way. This part of the structural operations was completed about the middle of June. The brick work followed very quickly. The roof was completed and the building rendered water tight during the month of September. At present the building is in process of drying out for the finished carpentry work.

The building is of three storeys, with high basement, the floor level of the latter being only four feet below grade. The main entrance is surmounted by a large square tower, standing 120 ft. above the street level. Generally, the building may be said to comprise four component parts. The basement covers the entire area of the building and is devoted solely to workshops. Above the level of the basement two large courts appear, each about 120 ft. x 90 ft., leaving the second and third parts, viz., the north and south series of class rooms, beautifully lighted both from the front and from the courts. The fourth component part is the central portion which is occupied by a large auditorium with the construction room in the rear. The gymnasium and plunge-bath are placed below the auditorium, additional class-rooms, devoted to architectural drawing, being located above.

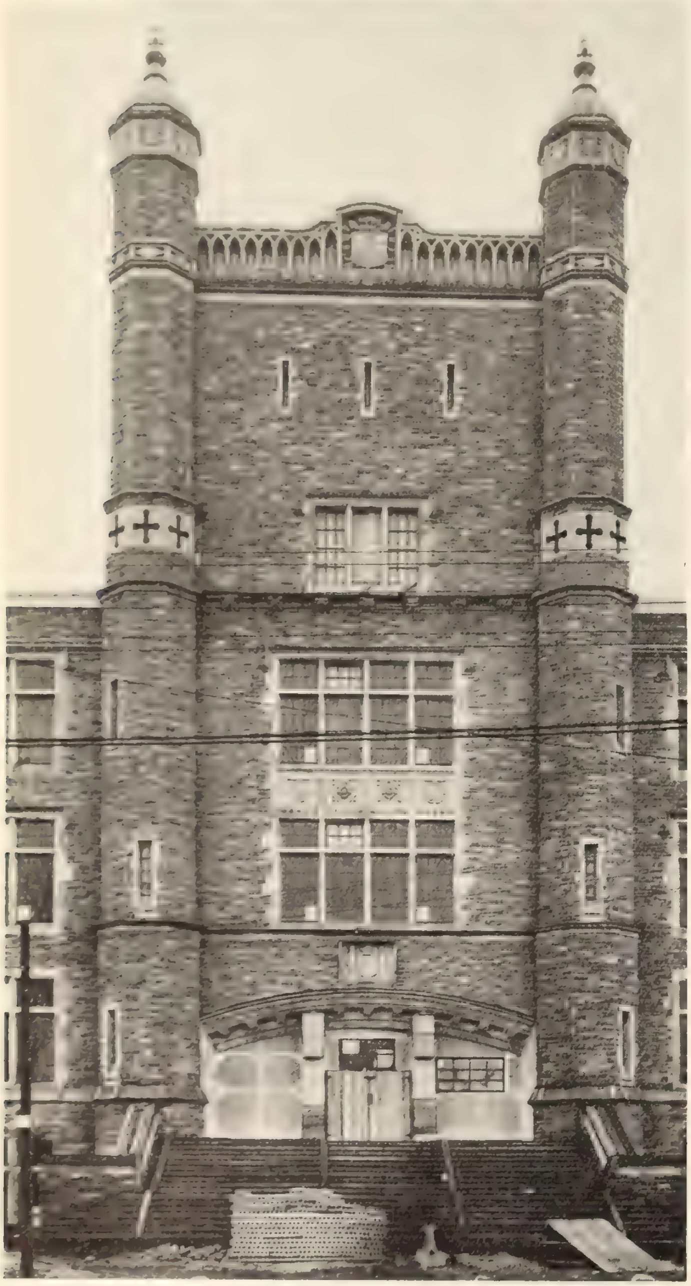
The style of architecture is simple and plain, it being Gothic in character, with English feeling. There have been slight modifications of the floor plans since their preparation, but the general principles have remained constant.

The main walls to all four elevations are constructed in Scotch snecked rubble with Credit Valley stone. A warm and pleasing effect was obtained by the use of 80 per cent. piebald stone and 20 per cent. pure grey. The stone trim to all window and door openings is Indiana limestone. The cope and part of the ornament of the tower is in terra-cotta. The court walls are Don Valley buff pressed brick.

Bare wall construction is used everywhere, except in the central portion of the building, where a steel frame was necessary to span the auditorium.

The sub-basement at the rear is an interesting building in itself. The floor is 27 ft. below the sidewalk. In this portion there is located a spacious engine room, boiler room, pump room, fan room, and coal pocket, with engineer's quarters so situated as to command a view of the engine room. The basement as already stated, is set apart for the accommodation of workshops. Each room is devoted to a separate trade. The walls are of pressed brick and the floors are finished in cement, specially hardened to withstand the traffic. The ceiling height here, as elsewhere, is 14 ft. 6 ins. in the clear. These workshops were laid out with a special view to obtaining good light, and the desired results were achieved in all of the seventy rooms on this floor.

Centrally located in the rear of the basement is the construction room, which is 36 ft. x 80 ft. in dimensions. This room has a 30-ft. ceiling. Here it is intended to carry on at one time the erection of two full-sized houses, in which work students from the various workshops will participate. Leading off from the First Floor corridor is a Visitors' Gallery in connection with this room.



Detail main entrance, Central Technical School, Toronto.

The corridors in the basement are typical of the building. The floors are terrazzo and the walls pressed brick, of a light buff color. A little relief is afforded by a 4-ft dado of a darker colored brick. The ceilings are furred and plastered in the form of an arch, with a height at the crown of 12 ft. The main corridors are 120 yards long by 10 ft. wide. No wood trim appears in connection with these corridors. All openings are finished with bull-nosed brick and the door frames are set well into the openings, this resulting in a clean, trim-looking corridor.

In the basement also are the gymnasium and running track, with shower baths and dressing rooms leading off. The plunge bath is finished in ceramic mosaic tile.

Large assembly rooms, bicycle rooms, and locker and toilet accommodation are provided at either end of the basement. There are six entrances to this floor —two on Borden street, two on Harbord street, and two on Lennox street.

Passing on to the First Floor, we have the main entrance on Lippincott street and two entrances on Harboard street. The main entrance, steps and platforms are made entirely of local stone, from the Credit Valley works. The main arch at the entrance and all of the stone work in the loggia are in Indiana limestone. Double sets of swing doors lead into the main hall, which is finished in glazed terra-cotta. The main corridors run off to the right and left, while in front is the main stairway, finished in marble work, leading up to the main auditorium. This stairway extends to the second floor from which level entrance is had to the gallery of the auditorium. This room has a seating capacity of about 1,800. It is finished in red oak panelling, with a lofty, ornamental ceiling, the combined effect being most attractive.

This auditorium is the only room in the building where the plain, severe treatment is departed from, ornamental work having been introduced to enhance the general appearance. At the west end of the auditorium there is a large rostrum and provision has been made here for the installation of an organ. Large casement windows, of Hope sash, which light the auditorium from both sides, are a feature. The dimensions of the auditorium are—length, 100 ft., and width, 80 ft., with a ceiling height of about 38 ft. The corridor leading off the main hall to the north end gives access to the Principal's Room, the Board Room, a series of class rooms and a large Exhibition Room. On this floor there is a smaller lecture theatre, with a seating capacity of over two hundred, which will be used for students as well as for public lectures. Steel cabinets, in accordance with the Underwriters' requirements, are provided for moving picture operations.

Leading off to the south of the main hall the corridor gives access to a large reading room and a series of physical laboratories, mathematical laboratories, and general class-rooms. All these rooms will be fully equipped. In structural design and treatment the corridors of these floors are similar to those in the basement. Both the corridors and the class-rooms are flooded with light—a feature of the building which formed a special study of the architects.

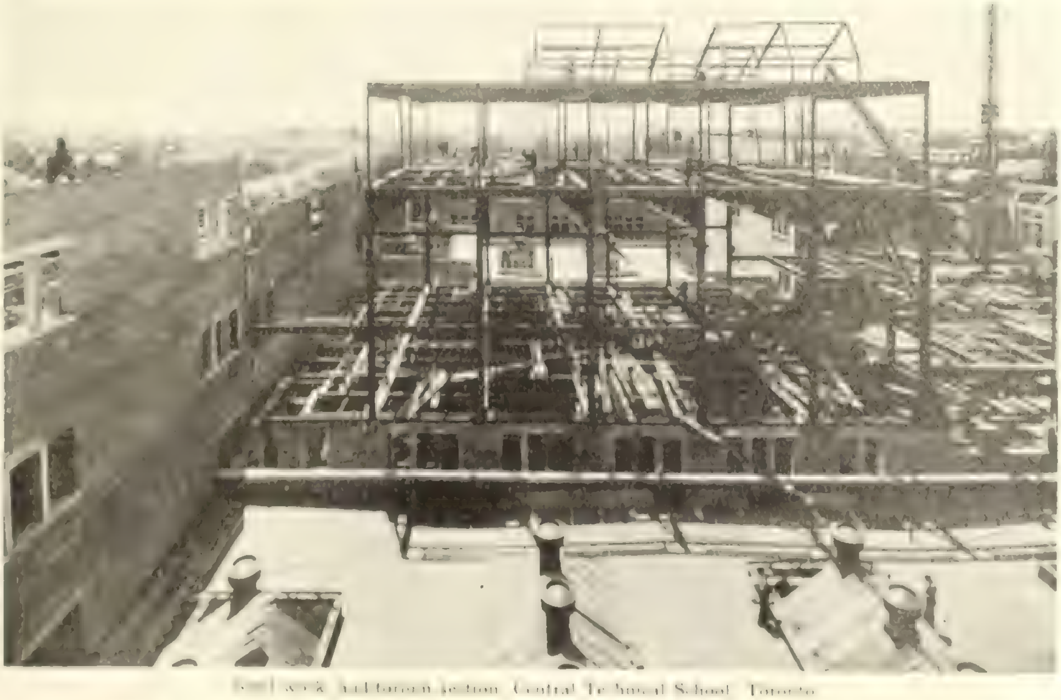
The Second and Third Floors are, in the main, a repetition of the First Floor so far as the layout is concerned. The Second Floor is devoted almost entirely to women students, where the two departments of Domestic Science and Domestic Art will be carried on. In the north-west corner of this floor there is constructed a model apartment consisting of dining room, kitchen, servants' room, servants' pantry, bedroom and linen cupboards, the intention of the authorities being

Excavating for sub-basement, Central Technical School, Toronto. Photo taken October 31, 1913.

to demonstrate the rudiments of Domestic Science. On the same floor is a large laundry, which will be equipped with modern machinery, bacteriological laboratories and millinery workshops. A large lunch room, with kitchen adjoining, is provided for the male students, and another, of smaller dimensions, for the women students.

The Third Floor contains another series of classrooms. The south end of the building is devoted to chemistry, with metallurgical laboratories for quantitative and qualitative analyses, also for elementary and applied chemistry. Each department possesses its own lecture room, with a preparation room behind, and ample locker and toilet accommodation. In the centre of the building the class-rooms are devoted to art, where object drawing, clay modelling, architectural and free-hand drawing will be carried on. The north end of the building is allotted to engineering and mechanical drawing.

In all there are about two hundred and seventy rooms in the building. The typical room is 28 ft. 6 ins. wide and on an average about 50 ft. long, with a ceiling height of 14 ft. 6 ins. The windows throughout are Hope sash and on a transverse section of the main wall 43 per cent. is daylight opening. Owing to this fact it was necessary to make these exterior walls half a brick thicker than is called for under the Toronto building by-laws. Each room is ventilated mechanically from a power plant in the basement, the supply and exhaust matter being led to each individual room.



Steel work, Auditorium section, Central Technical School, Toronto.

Vacuum cleaning outlets are being provided in each room and the heating is controlled thermostatically.

In each room there are sliding and stationary blackboards. Over one mile of blackboards will be provided throughout the building.

The lecturer's platform is 7 in. above the main floor level. It has a 12-ft. table, fully equipped with electric power outlets—gas, compressed air, hot and cold water, and, where necessary, vent ducts for drawing off fumes.

In the physical and chemical departments the tables allotted to individual students, as well as the lecturer's table, are provided with the above equipment.

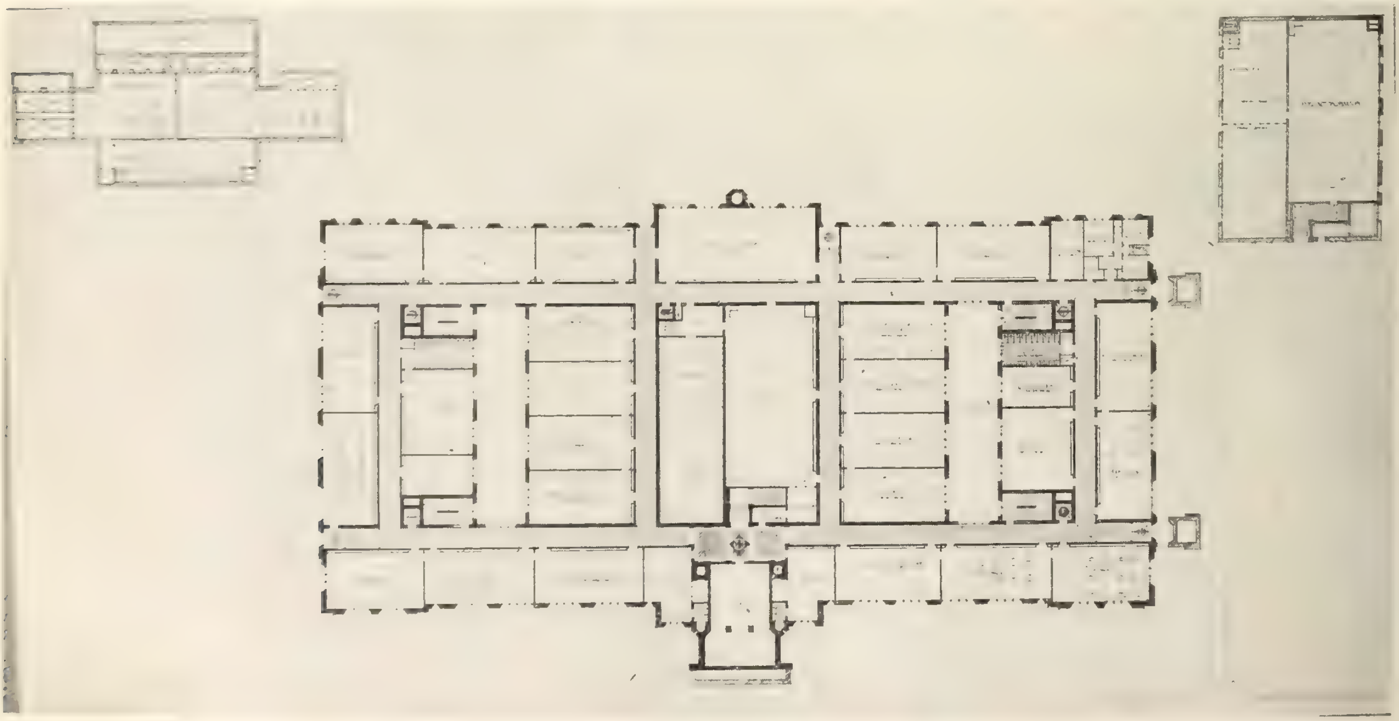
At each corner of the building, leading directly into the corridor, there is a fire stair enclosure, equipped with the usual Underwriters' doors, and on the exit doors, immediately adjacent, fire stair doors will be equipped with panic bolts. On each corner facilities are provided for passenger elevators. At present only one is being installed—in the south-west corner. There is a freight elevator at the rear.

The mechanical installation in this building, which is under the supervision of the Canadian Domestic Engineering Company, will be one of the finest in Canada. The building will be heated and lighted and all power supplied from a 750 h.p. Babcock & Wilcox installation. It will have its own generators in the engine room, supplying light and high tension current for power. Air compressors are provided for supplying the various lavatories, and a refrigerator system for experimental purposes is also being installed.

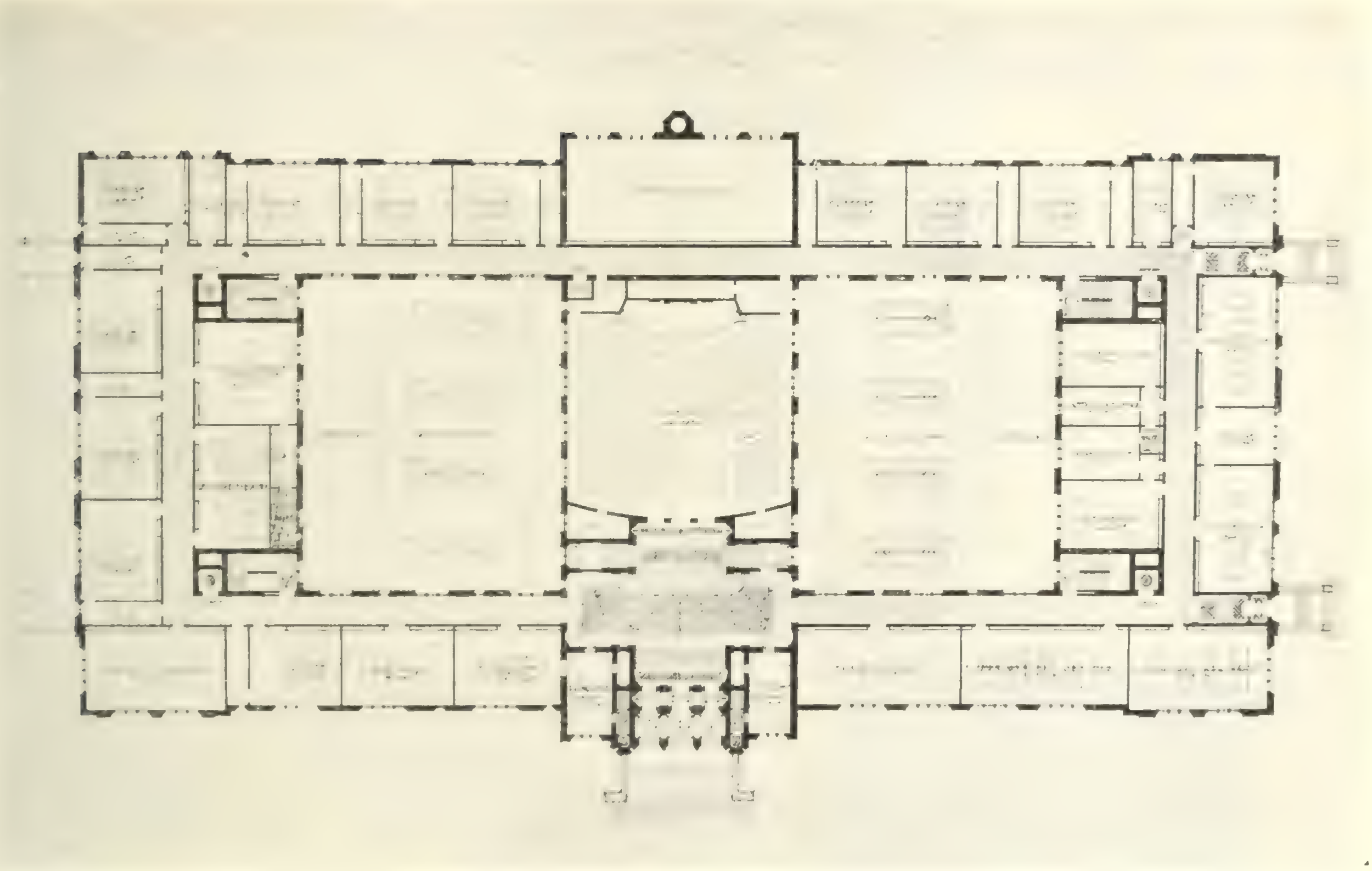
The heating is the single-pipe force hot-water system and over and above this the air passing from the ventilating system is tempered before it reaches the rooms. The air is brought into the building through a large fresh-air duct leading to the sub-basement, about 25 ft. x 10 ft. in cross-section. The air is first heated in a large vento, then passed through air washers and re-heated, two large Keith fans forcing it through the pipe tunnels. The ventilating system is in duplicate, the north half of the building being entirely separate from the south. The pipe tunnels run below the basement floor and encircle the whole building. From these tunnels galvanized iron ducts rise throughout the building. These ducts are again gathered at the roof and brought into two large exhaust boxes immediately behind the tower in the centre of the building. In the pipe tunnels radiators and deflecting plates are provided at intervals, so that the amount of air admitted into the room can be regulated to a nicety. A small continuous filtration plant is provided for the plunge bath in order that the water shall be pure at all times and not have to be drawn off at intervals.

The remainder of the equipment in the building—more particularly the equipment in the various shops in the basement—will form the subject matter of a later article.

The building contains approximately 400,000 ft. of porous terra cotta fire-proofing, upwards of 2,000,000 pressed bricks of different shades of buff, more than 7,500,000 common bricks, and a large quantity of enamelled bricks of special sizes used in the corridors. This material was manufactured and supplied by the Don Valley Brick Works, Toronto. The sand and gravel in the building were supplied by the York Sand & Gravel Company, Limited. The general contractors are the Norcross Brothers Company. Other contractors on the work are: plumbing, Fred Armstrong Company, Limited; electric wiring, Keiths Limited; elevators, Turnbull Elevator Manufacturing Company; structural steel work, Dominion Bridge Company, Limited; Credit Valley stone and mason work, Messrs. Rees & Hawken; Barrett Specification roofing and waterproofing, Canadian Supply & Contracting Company, Limited; metal sash, Henry Hope & Sons, Limited; Indiana limestone, Messrs. Geo. Oakley & Son; architectural terra cotta, Federal Terra Cotta Company, New York; painting and glazing, Hughes & Company; plastering, Mr. R. C. Dancy; sheet metal and calamine work, W. E. Dillon Company, Limited;



Basement plan, Central Technical School, Toronto.



First floor plan, Central Technical School, Toronto.

ornamental ironwork, including Modern Method stairs, Canadian Ornamental Iron Company, Limited; glazed terra cotta in interior, Northwestern Terra Cotta Company; heating and ventilating, Canadian General Fire Extinguisher Company, Limited; interior finish, Oshawa Interior Fittings Company; red oak doors, Compound Door Company, St. Joseph, Mich.; tables for equipment, Berlin Interior Hardwood Company; electrical work in connection therewith, A. B. Rice Company.

The structural engineering work was designed by the Structural Engineering Company, Montreal, in conjunction with the architects, Messrs. Ross & Macdonald, of Montreal and Toronto.

The cost of the building in round figures is $2,000,000. The site involved an outlay of $350,000. The building alone will cost about $1,400,000 and the equipment some $250,000.

C.P.R. Freight Terminals at Quebec

FROM designs prepared by the Building Construction Department of the C. P. R., Mr. W. S. Downing-Cook, of Montreal, is erecting at Quebec a system of fine freight terminals, under the direction of Mr. D. H. Mapes, Superintendent of the Company's Building Construction Department. There are two sheds, one for inbound and the other for outbound traffic; the foundations of these are on Raymond concrete piles, the floors being built of reinforced concrete, with the structure supported by steel rafters and girders. The inbound shed is 50 ft. wide by 600 ft. long, and the outbound shed 30 ft. wide by 400 ft. long. They are both constructed on the unit system, which allows either or both to be lengthened by the addition of other units. A transfer platform will be installed between the sheds, while the tracks are laid in such a way that freight cars may be shunted alongside both platform and shed. The arrangement of the sliding doors is novel, and will afford great convenience to merchants. These doors will be continuous the full length of both the track and roadway sides of the sheds, and will give an entrance at any desired point, thus facilitating the work of loading and unloading and saving considerable time.

The sheds will be fronted with a two-storey office building, 50 x 100 feet, for the staff, and through this access to the sheds may be gained. The buildings and sheds will be lighted with electricity. The contract will be finished by the middle of April, when it is proposed to commence the erection of the new union station of the C. P. R. and Tarnscontinental. This will necessitate the demolition of the old freight building. The new freight terminals will cost about $250,000. The steel work was designed by Mr. P. B. Motley, Engineer of Bridges, C. P. R.; Mr. S. G. Newton is superintendent for Mr. W. S. Downing-Cook. The steel is furnished by the Dominion Bridge Company, of Lachine; Douglas Bros., of Montreal, have the contract for the roofing and doors; the painting is being done by Schulmerich & Company, Montreal; and the brick work is let to the Citadel Brick Company, of Quebec.

Tests on thermit welded pipes from 1 to $1\frac{1}{4}$-in. in diameter, made by Prof. Frederick L. Pryor of the Stevens Institute of Technology, have shown that the tensile strength at the weld is practically the same as for straight pipes without joints and considerably higher than the strength of standard threaded sleeve couplings. Subjected to bursting tests all specimens ruptured in the seam of the pipe.

Recent Practice in Bituminous Construction and Maintenance[*]

By Wm. D. Uhler[†]

MANY perplexing problems arise in the construction of bituminous pavements, especially on streets occupied by railway tracks, where many failures occur alongside and between the rails due, in most cities, to old agreements, contracts, etc., which prevent the authorities from compelling the railway companies to reconstruct their tracks in accordance with the present-day standards. For instance, in Philadelphia, with few exceptions, practically all of the trolley tracks are ballasted with the natural soil, which is a sandy loam. This not being a rigid construction, there is more or less movement of the rails, which damages the pavement. The ideal construction, from the standpoint of the paving, is to place concrete under the ties, and it is usually found advisable, as well as more economical, to place runners of at least one row of blocks on either side of the rails to take the shock and extra wear caused by heavy traffic turning on and off the tracks. There is a difference of opinion among engineers as to the character of blocks best suited for this purpose—scoria, vitrified, wood and granite blocks are used largely—but experience indicates that the most satisfactory results are obtained from the use of close fitted granite block runners, bedded in the green concrete, and well grouted.

The Author, Mr. Wm. D. Uhler.

Philadelphia's specifications for sheet asphalt are substantially the same as those adopted at Pittsburgh in 1913 by the Association for Standardizing Paving Specifications. The Country Road Bituminous Specifications include the so-called patented pavements—Amiesite, Filbertine and Warrenite, and a Bituminous Concrete somewhat similar to the Topeka mixture. Each bidder can bid only on one type of pavement, and the work is awarded to the lowest bidder, irrespective of the type bid on, the pavements being in competition with one another.

The following are abstracts from these specifications which show the mineral aggregate and the percentage of bitumen used in each pavement.

Amiesite

The mineral aggregate shall be clean, crushed trap rock of approved quality, the maximum to pass a 1½-inch ring and so graded as to produce the densest mixture. The mineral aggregate shall be treated with a liquifier to make the asphalt adhere. The asphalt heated to about 275 degrees shall then be added and after the mineral aggregate is thoroughly coated, oxide of lime shall be added. The ingredients referred to above shall be mixed by weight in the following proportions: mineral aggregate, 92 per cent.; asphalt, 5 per cent.; lime, 1½ per cent.; liquifier, 1½ per cent.

Filbertine

The mineral aggregate in the Filbertine mixture shall be within the following proportions best suited to make the densest mixture: ¾-inch stone, hard crushed, 55 to 65 per cent.; sand, coarse to fine, 35 to 45 per cent.; mineral dust, 4 to 6 per cent.; asphalt cement, 6 to 8 per cent.

Warrenite

The stone, with or without the addition of sand, graded in the following proportions so as to give the wearing surface the greatest degree of density, rigidity, inherent stability and freedom from voids: material passing 1¼-inch screen and retained on a No. 2 sieve, 40 to 60 per cent.; material passing No. 2 sieve and retained on a No. 4 sieve, 10 to 20 per cent.; material passing a No. 4 sieve and retained on a No. 10 sieve, 10 to 5 per cent.; material passing a No. 10 sieve and retained on a No. 30 sieve, 10 to 5 per cent.; material passing a No. 80 sieve, at least 25 per cent. of which will pass a No. 200 sieve, 10 to 5 per cent. The balance to pass a No. 30 sieve and be retained on a No. 80 sieve.

From 5 to 10 per cent. of Warrenite cement as directed sufficient in quantity to coat each particle and fill the voids remaining between the stones.

Bituminous Concrete Specification

The finished pavement shall contain between 8 per cent. and 11 per cent. of bitumen, depending upon its composition, but in all cases, sufficient asphaltic cement shall be used to thoroughly coat all the particles of the mineral aggregate. Fine mineral aggregate shall be proportioned by weight as follows: Portland cement or stone dust passing No. 200 sieve, 10 to 15 per cent.; sand, passing No. 80 sieve, 18 to 36 per cent.; sand, passing No. 40 sieve, 20 to 40 per cent.; sand, passing No. 10 sieve, 8 to 25 per cent.; sand, passing No. 4 sieve, up to 10 per cent.

With this fine graded aggregate, there shall be used a proportion of clean, hard limestone with a co-efficient of wear of not less than 10, or trap rock chips with a co-efficient of wear of not less than 15, all of which will pass a ½-inch screen and be retained on a No. 10 screen, amounting to approximately 25 per cent. of the whole aggregate.

It might be well, in this connection, to state that paving authorities, when admitting in competition any of the proprietary or patented pavements, should insist upon a full and complete specification for each of the types in question, so that when a pavement is laid, the engineer will have sufficient knowledge of the materials comprising the pavement to enable him to control its construction. No pavement of any character is laid in the city of Philadelphia unless information is furnished; first, as to the quality and proportion of the material to be used; second, the preparation of the mixture at the plant; and third, the proposed method of laying the mixture on the prepared foundation.

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[*] Paper presented at the Annual Convention of the American Road Builders' Association held this week at Chicago.

[†] Principal Assistant Engineer, Bureau of Highways and Street Cleaning, Philadelphia.

In the preparation of the mixture all materials are subjected to rigid plant and laboratory inspection. During the actual operation, inspectors, with engineering education or training, are assigned to each asphalt plant, to inspect as far as can be done at the plant, the raw materials as to quality and mechanical grading of the sand, crushed stone and mineral filler or stone dust, and daily samples representative of the materials used and mixtures made at the plant are sent to the central laboratory where they are tested, and the results filed as a permanent record of the pavements laid.

The specifications stipulate the penetration of bitumen and temperature within limits sufficiently wide to cover all conditions, but definite instructions covering these two points and based on the amount and character of traffic are given to the inspector for each contract.

The foundation having been laid to true line and grade, the next step is to obtain a correct and uniform depth of binder and wearing surface, raked to a true cross section and grade, after which it must be thoroughly rolled; and without doubt the most important single point in the laying of bituminous wearing surfaces is the question of rolling. More pavements are failing today through displacement from their original form than from all other causes combined, and aside from the other reasons to which this result may be attributed, and there are undoubtedly many, it is certain that unless a pavement is free from waves at the time of its completion, it never will be, as the tendency of the pavement is to push under traffic which increases the wavy condition. It is important, therefore, that all pavements be thoroughly compressed, carefully rolled and cross rolled, with properly maintained rollers operated by skilled roller engineers. It has been the practice in some cities to use only one roller, but far better results can be obtained by using a light roller for the initial compression and a heavier roller for the final compression. The best results obtained in Philadelphia have been by an equal amount of transverse and longitudinal rolling with a 2½-ton roller, followed by an equal amount of transverse, longitudinal and diagonal rolling with an 8 to 10-ton roller.

In the laying of sheet asphalt or bituminous concrete, where brick gutters are used and adjacent to block runners along car tracks, it is good practice to lay the finished surface of the pavement from one-eighth to one-quarter of an inch higher than the brick gutters or runners. It is difficult in the rolling to secure final compression next to these blocks, and traffic will further compress that portion of the pavement, naturally causing the development of low spots which hold water and result in deterioration.

It is questionable whether, as compared with the old so-called open binder, the latest specification for the binder course which calls for a grading of stone from 1 inch diameter down, with the addition of 25 to 35 per cent of sand, producing a mixture with greatly reduced voids, does not result in giving a decreased mechanical bond for the wearing surface, and whether, in view of the possibility of the top shifting under traffic, it might not be advisable to use the open binder exclusively.

In the grading of the mineral aggregate, special attention must be paid to the percentage and penetration of the asphaltic cement which, of course, is dependent upon the asphalt used, climatic and temperature conditions, and the character and amount of traffic.

The following is the present practice in Philadelphia under average conditions:

Philadelphia Surface Mixtures, 1914

Traffic Conditions:	Light	Medium	Heavy	Patching
Per cent. Bitumen...	10½	10¾	10¾-11.0	10¼
Penetration:				
Mexican	60-65	50-60	45-50	50-55
California	60-65	50-60	45-50	50-55
Bermudez	60-65	50-60	45-50	50-55
Trinidad	55-60	45-55	40-45	45-50

Note:—Bitumen figures varied slightly from the above to take care of unusually fine or coarse sand.

Bituminous Macadam Penetration Method.—In penetration work, after the base has been prepared, and clean, approved hard stone has been spread to the required depth, the recognized practice is to use from 1¼ to 1½ gallons per square yard of bituminous material conforming to the specifications. Then after chipping and rolling, a flush or seal coat is applied of from ¼ to ½ gallon per square yard and another application of chips, before the final rolling.

The tendency has been to discontinue this method of construction, where it is practical to use the mixing method. Although it is an admitted fact that the penetration method is slightly cheaper than bituminous concrete in first cost, when the life and maintenance of the respective pavements are taken into consideration, it is doubtful whether the penetration method is not more costly than the mixing method.

There probably has been more deterioration in roads built by the penetration method than in any other modern type of construction. Generally speaking, this is due to too much personal equation entering into the work, as, for instance, unequal distribution of binder, resulting in the formation of waves and ruts which always grow worse under traffic. The method of heating the binder is not as easily controlled as in a mixing plant and often results in overheating, causing weak spots in the pavement. Even if the method of construction were more ideal, it is questionable whether the penetration method should be used, as at the present time there are on the market a number of portable mixing plants of all sizes that would be practicable in most sections of the country, and it is generally conceded that the mixing method is preferable to the penetration, provided first cost is not the dominating factor.

Bituminous Pavement Mixing Method.—The specifications in the city of Philadelphia are as definite and rigid in their stipulations covering the preparation and laying of bituminous concrete pavements as they are in the case of sheet asphalt. All these pavements are now being laid on a 4-inch concrete base instead of on an existing macadam foundation, which heretofore has been the generally accepted practice on country roads. In view of the increased amount and change in character of the traffic, even though slightly more expensive, it has been considered advisable to provide for a 4-inch concrete base on top of the broken stone or Telford base, due to the tendency of the macadam base to shift or further consolidate under traffic and possible sub-grate trouble, all of which tend to bring about a wavy or uneven surface.

In resurfacing old waterbound macadam roads, where the road consists of either telford or macadam base, the broken stone surface is removed to a depth sufficient to conform to the required cross section and grade. Where the telford surface is exposed the irregularities are broken off with a napping hammer and the depressions filled in, and upon this prepared surface is placed a 4-inch concrete base, mixed in the proportions of 1:3:6, so laid as to secure a very rough but regular surface to form a bond between the concrete base and the bituminous top. In conjunction with the concrete base a concrete header curb is constructed extending 6 inches beyond the fixed edges of the bituminous pavement and to the finished grade. After the concrete base has developed a hard set, and from one to two days prior to the placing of the bituminous wearing surface, the base is thoroughly cleansed of loose and foreign material, by sweeping, and is then covered with an asphaltic cut-back mixture consisting of equal parts by volume of asphaltic cement, 55 to 65 penetration, and commercial naphtha, 52 to 55 gravity; the mixture being supplied by a pressure distributor at the rate of ⅛ gallon per square yard. The object of this paint coat is to secure a better bond between the concrete base and the bituminous top. The bituminous top, 2 inches in thickness, is laid under the same requirement as to preparation, laying, rolling and inspection as for sheet asphalt. Where a new pavement is laid on the earth sub-grade a 5-inch concrete foundation is used.

One of the important features in connection with obtaining the best results in bituminous concrete construction is the use of good, hard, durable stone, free from dirt and decomposed material, in the wearing surface, as decomposed stone in the mixture will naturally develop weak spots in the pavement, ultimately resulting in failure.

The following penetrations are used in Philadelphia:

	Heavy Team or Motor Traffic Penetration	Medium or Light Traffic Penetration
Trinidad Asphalt	40-50	50-55
Bermudez, Mexican and California.	50-55	55-60

There always has been a tendency to slight or overlook details in this class of work, and as an illustration the following is quoted from the Fourth Annual Report of the Association for Standardizing Paving Specifications, 1913: "In the case of a park driveway or a suburban highway, a bituminous concrete pavement may be successfully used without a curb; no other protection for the edge of the pavement is required except to provide a coarse, grainy surface into which the paving material is rolled." There is no question but that this was the generally accepted practice at the time this report was made. Later experience, however, has demonstrated that this method of construction might answer for wide roads with light traffic, but where the width of the paved surface is 18 feet or less, the turning of traffic on and off the bituminous surface will result in grinding or cracking the edges and also, unless a perfect bond has been secured with the base—and this cannot be relied upon—heavy wheel loads, at a distance of 1 to 2 feet from the edge, will produce a spreading of the bituminous surface. To obviate this, provision is made in the Philadelphia country road specifications for a 6-inch concrete header curb on either side of the road where the road is not paved to the full width.

The idea that the introduction of stone into the bituminous mixture is a cure for all the troubles which have developed in recent years with sheet asphalt, is wrong. Topeka and later specifications developed from it, calling for about 25 per cent. of ½-inch stone, cannot be considered ideal bituminous pavement, as the stone is not sufficient in quantity or size to produce the interlocking required for stability in the mineral aggregate. In laying this type of pavement the segregation of the mixture in pockets of fine and coarse material, will produce a pavement with irregular wearing qualities, unequal compression and unequal ability to resist displacement by traffic; with the use of stone in large quantities a much more stable pavement is secured, but an element of danger is introduced with the use of large stone, in the mixing and laying, brought about by the segregation of the large and small sizes of stone, with the result that the pavement will not be as uniform in character as is the case with a standard sheet asphalt pavement.

Maintenance of Bituminous Pavements.—We all know the success of any pavement depends on the maintenance, and the success of maintenance depends largely on attention to details, for instance, in cutting out the old material and cleaning the base, placing the new material, rolling, etc. Judgment and experience are necessary in determining the extent of the work to be done and the amount of material to be cut out for each individual patch. A patrol maintenance system will do more to preserve roads and pavements and prevent deterioration than any one thing.

There are two methods that can be considered for the maintenance of bituminous pavements by contract; first, by the square yard, and second, on the tonnage basis. Working on the square yard basis, there is more or less of an element of chance taken by the contractor as to the depth of binder and top to be laid, due to the age and unequal wear of the pavement, and as the binder is naturally the cheaper, the contractor is apt to increase the depth of the binder and decrease the depth of the top. On the tonnage basis, due to the fact that the price bid for the binder is usually about one-half that for the top, there is a tendency on the part of the contractor, unless the work is closely inspected, to cut down on the amount of binder and to increase the amount of top. Thus in the two methods the case is reversed. On the tonnage basis, however, since payment is made only for the actual amount of binder and top used there is really no "gamble" on the part of the municipality or the contractor as to the amount of each class of material to be furnished, which is the case on the square yard basis. It is, however, more desirable for the city to own an asphalt plant as this class of work can be handled more satisfactorily by municipal forces than by the contract system.

In order to assist in solving many of the perplexing problems arising in connection with paving work, it has been found advisable to build experimental and service test roads. If this practice had been consistently followed the result would be that we would not have the extensive failures we have had through the use of untried materials and methods of construction, which should have been tried out experimentally on a small scale such as was done in Maryland on Park Heights Avenue, built in 1910; and the White Plains experimental road, Borough of the Bronx, New York, built in 1910. A Service Test Roadway such as built in Philadelphia in 1912-13; and Second Avenue, New

York, built in 1912, which comprise more or less standard methods of construction and materials, should be of great value in compiling permanent records of the comparative value of the different types of the present-day standard pavements. Work of this kind should be encouraged as it will ultimately result in solving many of our paving problems. Detailed information relative to Park Heights Avenue, White Plains Road and the Service Test Roadway has been published in report form and distributed to the public, but, up to the present time, no information has been available with reference to the Second Avenue work. It is hoped, however, that these data will be made public in the near future.

If we are to arrive at any solution of our troubles, it behoves all of us to be frank and, instead of coming to the various road conventions and telling of the successes, we must come to the front and tell of the failurea, as it is an indisputable fact that every State or Municipal officer here today is having his failures. This being the case, why not give the "other fellow" the benefit of your experience? If this thought were carried out there would be less failures.

*Note.—"Equal parts by volume" may be said to be 58 to 60 per cent. by weight of asphalt and 42 to 50 per cent. by weight of naphtha. This is not definite, as we should have specified equal parts of melted asphalt.

The Disposal of Trades Waste

By J. W. Sheridan

In treating a subject in a paper such as this, it is necessary to keep within certain limits as to length. It cannot be hoped, then, to go fully into all the aspects of the matter under consideration, or even to do justice to the points actually raised. Under these conditions the object of the paper will be attained if a certain amount of interest in regard to the various difficulties and questions arising out of and surrounding the disposal of Trades Waste is aroused amongst the members of the Society. It is in the hope, therefore, of opening up an interesting, and not very widely discussed side of sanitary engineering to the consideration of the Society that this paper is submitted.

Many things enter into the disposal of Trades Waste: engineering, mechanical and civil; bacteriology; and chemistry, to mention but a few. Chemistry and bacteriology are, perhaps chiefly concerned with the recovery of useful matters from the waste; either such as can be re-used in connection with the industry producing the waste, or such as may be useful in some other way; manurally for example. In both these cases the cost of recovering the useful portion of the waste must, other things being equal, be justified by the amount and value of the useful agent recovered. Engineering knowledge is required in this connection for the carrying into effect of the chemist's or bacteriologist's ideas as to the recovery of the useful parts of the waste in suitably designed and constructed recovery plants. It is also necessary in making provision for the ultimate disposal of the useless parts of the waste, in such a way that they may create the least possible nuisance to the community which might later be affected by such waste.

Equity may also have something to say in the matter, and may demand two things, the one, that the industry from which the waste arises shall not be unjustly hindered with the necessity of a superfine purification or a two exactive disposal of its waste. The other that the community or communities naturally or artificially affected by the existence of the industry, in whatsoever way, shall be properly safeguarded from the abuse of their natural rights that might arise from the existence of the industry and the waste arising therefrom.

It is the intention of this paper to touch to a greater or less degree on each of these salient points with regard to the disposal of trades waste. No one of them is of less importance than the others, and they are, indeed, to a great degree interdependent, and must be considered so especially by the engineer, who as a kind of modern jack-of-all-trades—though it is to be hoped not "master of none"—should have a smattering of all matters touching his profession, and should also have the faculty of seeing their relative values in true proportion.

Treatment or Purification

The first question that arises in connection with the disposal of Trades Waste is: When does trade waste require treatment or purification before being turned into the nearest sewage carrier? The answer to this question will vary in each individual case. When a manufacturing industry is situated on a seaboard there may or may not be a necessity for purification. If situated on a tidal estuary the shoals of which are densely populated some effluents will certainly require to be purified. The necessity for treatment, will however, be dependent on many considerations. The quality and quantity of the effluent may perhaps be the most important of these, but some others of equal importance can be named, e.g., the character of the bottom; the value of the fishings likely to be affected, especially in the case of oysters and some other fish beds in the vicinity of the outlet; the velocity of the ebb and flow of the tides, and the directions of the currents at all states of the tide. Similar conditions affect the disposal of trades waste discharged into rivers and lakes. The quantity and composition of the effluent and its likely effect upon the stream or lake must be carefully gone into before a decision is arrived at as to the amount of purification, if any, required before its discharge.

In the same way where trades waste discharges into a common sewer of a public authority its possible effect upon the sewers and purification plant of the authority should be considered, and the more so that the discharge of trade effluents into common sewers is a frequent source of difficulties arising between the manufacturer and the public authority.

The polluting effect of trades waste arises from various causes: (1) An excessive quantity of solids in suspension. (2) Agents in the effluent liable to ferment or putrefy and hence create a nuisance. (3) Coloring matters. (4) Substances liable to poison fish life, aquatic vegetation, or persons or stock using the stream for drinking purposes below the effluent. (5) Oily matters such as soap, fat, and grease.

Amongst the industries producing waste effluents containing large quantities of matter in suspension are

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Paper read before the Regina Engineering Society.

tanning, cotton and woollen making industries and the paper making trade. Effluents from ammonia recovery plants, potteries, and bleach and dye works are also offenders in this respect. The waste liquids from breweries, distilleries, glue and beer root sugar fatcories, and from the tanneries and hide-dressing works contain highly fermentative and putrifactive constituents. Dye works, calico printing works and the like produce highly colored wastes. The number of trades discharging effluents injurious to organic life is very large, amongst them may be mentioned bleach or dye wastes, paper mills, ammonia recovery plants and many others. Soap factories, wool coloring works and laundries are the most frequent producers of oily, greasy and fatty wastes.

Waste Effluents and Methods Adopted

It may not be out of place here to give a short sketch of some industries, giving a rough description of the processes involved in them, and a general idea of the methods adopted to counteract the action of such wastes before allowing them to pass finally into sewers or water courses.

Fell-mongering is an important trade carried on in connection with both the woollen and leather industries. The object of fell-mongering is to remove the wool or hair from hides and skins. The dried hides are first of all soaked for from four to seven days in water, they are then steeped in milk of lime and thoroughly brushed in a brushing machine to remove extraneous matters from the wool. After this hides, which may or may not be washed again to remove the milk of lime, are scraped, and the hair or wood sent to the wool conners while the skins are sent to the tanners. As might be expected the waste from the scouring and washing operations is of a very polluting nature containing lime, dirt and sand, and fragments of putrifying flesh. The washing process also produces a considerable quantity of solid matter in the form of sludge. This latter has a high manurial value and should be easily disposed of for that purpose. With regard to the wash and scour waters, these should be settled and screened before turning into a common sewer, the object of course, being to reduce as much as possible the solid matters in suspension, which might otherwise create a nuisance. The liquid element from fell-mongering works has been found to be amenable to the ordinary treatment given to domestic sewage on bacteria beds when mixed with it and discharged at a fairly moderate rate; but when it cannot be diluted with a much larger volume of sewage its bacteriological treatment may be facilitated by precipitation of the suspended solids with sulphate of lime.

After the hides pass into the hands of the tanner they are soaked in tanning solutions of various strengths, and finally pickled in salt, and put to dry and mature. The refuse liquid resultive from the tanning process, which is usually carried on in conjunction with the fell-mongering trade, is very foul and should be mixed with the effluents from the lime and soak pits mentioned previously and treated with them.

Woolscouring is a process through which the wool is put after leaving the fell-mongers. The wool is passed through a series of tanks, the first two containing hot soap solutions and the last clean water. The liquid run off from the first two tanks is very dirty and greasy; it is worth while to recover the grease. The process usually adopted in so doing is to first screen and settle the effluent thus removing the detritus and solid matter, and afterwards treat it with sulphuric acid to neutralize the alkali decomposing the soaps. The effluent is next passed through sedimentation tanks on the continuous flow system. These tanks are usually designed to hold about a quarter of the dry weather flow. The sludge is allowed to accumulate in the tanks and is afterwards discharged into vats where it is dosed with sulphuric acid and afterwards heated to boiling point of water by the application of steam. The sludge is then passed under compresesd air through filter presses which are kept hot by steam, and the grease flows off with the press liquor and is easily separated from it by skimming. After being cooled and purified the grease is barrelled and sold. Only twenty per cent. of the grease is removed by this process, but by distillation in retorts at a temperature of 600 degrees Fahrenheit the grease remaining in the sludge can be volatilised and afterwards condensed, leaving the residue in the form of a dry powder.

Bleaching is the first process through which cotton passes after being woven into calico. Its object being to remove the weavers size and other substances added to the cotton thread during the process of weaving. Before bleaching the cotton passes through two or three processes the last of which is boiling in large iron Kiers with caustic soda or lime. The cloth is then washed in clean water, soaked in a bleaching solution, and again washed. It is afterwards soaked in a weak solution of hydrocloric acid, thus dissolving any lime remaining in the weave and finally washed.

Dyeing is very often carried on in connection with bleachworks. The method usually adopted in dyeing is to pass the cloth through a hot solution of colour, analine dyes being used. After dyeing the cloth is washed in clean water.

Calico printing may be considered as a branch of the dyeing industry. The method most in use in this trade is to print the colors off on the cloth from engraved copper cylinders or rolls, the colors being made up in a paste with gum, starch, flour and other glutinous agents and applied to the rollers. Just before the cloth comes in contact with the rollers all the color, except that adhering to the engraved portion of the cylinders is stripped off so that only the engraved portion is left in colour on the cloth. After printing the cloth is passed through a hot soap solution and then washed.

As can be readily realized a great variety of objectionable matter is contained in the waste from these trades. Amongst them are starch, lime, grease, soluble soaps, salts, of lime and soda, dyes, etc. As the three trades are usually carried on together it is in most cases possible to mix the effluents from them all at the same time. The suspended solids are easily precipitated by the use of lime or alumino-ferric, and by passage through continuous flow precipitation tanks a measurably clear effluent may be obtained. The remaining impurities can be removed by filtration, even the coloring matter being usually removable in this way due to the mechanical effect if coagulation and the straining action of the filter.

The treatment required for paper mill effluents varies somewhat with the class of paper manufactured. For the highest class papers having a highly finished surface, espanto grass is used. The grass is boiled for several hours in kiers with a solution of caustic soda, when the liquor is run off and the grass washed in clean water. It is then broken up in "potchers" and bleached, and again washed. After the addition of china clay it passes into the paper making machine, on an endless band of copper gauze, going through rollers which squeeze out most of the moisture, and then passing over many steam heated cylinders, till at length it is wound on the final drum as paper. The liquor run off from the kiers is usually mixed with the water from the first washing and evaporated to recover the soda, the second wash water is mixed with the other waste waters and settled out in shallow lagoons.

In the manufacture of writing papers dyes are used. The processes involved are similar to those for espanto grass papers, but the kier liquors are not so strong, and instead of being evaporated the first run-off is run into a lagoon and settled separately from the other liquids but in the same manner.

Brown papers are made from peat, old sacking, tarpaniline, rope, etc., and from the dirty nature of the materials used strongly polluting liquids arise. They are usually settled and filtered in the same way as previously mentioned.

In making newspaper wood pulp is used. In making this paper the caustic soda treatment in the kiers is seldom needed.. Ordinary settlement of the waste liquids is usually sufficient. The sludge from this process is, however, rather valuable, and if pressed can be readily disposed of for making into colored paper.

All paper making effluents are exceedingly alkaline and very injurious to fish life. This is owing to the large amount of caustic soda used in the process of manufacture. The suspended solids should in all cases be removed by precipitation with sulphate of lime and iron, and the clarified tank effluent passed through suitable filters before being turned into a stream, lake or sewer.

In the brewing industry the chief source of pollution in the waste arises from the wash waters used in cleaning barrels, fermenting tanks, and cooling vats. The waste contains considerable quantities of suspended matter in the shape of spent hops, grains, yeast, etc., and decomposes rapidly, producing lactic and butyric acids. It has a high temperature and a tendency to sour rapidly thus rendering it difficult to treat bacterially on filter beds. It can, however, be successfully treated by first precipitating the suspended solids with lime neutralized with copperas and afterwards turning onto percolating filter beds. Where a brewery effluent can be turned into ordinary domestic sewers its treatment is greatly simplified as the anaerobic bacteria in the sewer counteract the tendency of the waste to turn sour, but the vital point in connection with the treatment of this waste is to deal with it before it becomes an acid liquor.

Having sketched these few industries and given a more or less rough idea of the methods that may be employed in purifying the effluents arising from them, it will be now advisable to state a few general principles guiding the treatment of trade effluents in general.

Trades waste containing lime, calcium sulphide and sulphate (the effluents from ammonia recovering plants, gas retorts, and coke ovens, contain these constituents), magnetic oxide of iron (from analine stills) occulent and fibrous matters, etc., can in most cases be clarified by simple settlement in suitably constructed tanks, in certain cases mechanical filters or fine screens may be used. Fermentative and putrefactive effluents may be treated biologically in tanks and filters, but starching wastes are sensitive to anaerobic treatment and are more easily dealt with when mixed with ordinary domestic sewage. Industrial effluents containing coloring matters of vegetable origin, and belonging to the "aniline" variety which are alizarene derivatives may be precipitated by means of iron or aluminium salts, other colouring matters may be destroyed in biological filters when mixed with sewage. Apart from their color they are innocuous. Alkaline sulphides in effluents may be treated with an excess of lime or a mixture of lime and ferrous sulphate (copperas), but the precipitated sulphide must be settled out in tanks before the effluent is finally discharged to prevent the evolution of sulphuretted hydrogen which might arise if the liquor came in contact with free acid.

It is important that all acids and alkalis unless present in very limited quantities should be neutralized before their final discharge. Chlorine in small amounts in either its free state or as hypochlorite is not likely to cause much trouble in sewers, but should not be allowed to pass into streams or lakes except in merely nominal quantities. Sulphuric acids of benzent and napthalene are open to ordinary treatment at sewage purification works when sufficiently diluted and mixed with domestic sewage, but are very injurious to the microscopic life in fresh water. The same remarks apply to effluents containing sulpho-cyanates, thio-sulphates and sulphides. Free particles of grease present in a trades waste should be trapped before the final discharge of the effluent into either sewers or streams. Soaps can be broken up by acids and separated and purified, or simply precipitated with lime.

The importance of the adequate treatment of trades waste can be realized from even so cursory an outline of the subject. There can be no doubt as to its necessity. Local Government Boards, local and public health authorities, and others having jurisdiction over foreshores, lakes and streams, and common sewers would seem to have a clearly defined duty confronting them in the making of regulations governing the discharge of trades waste effluents in the different spheres of their authority. Manufacturers are in business for profits, and. unless they can see material benefit accruing to themselves by so doing, are extremely unlikely to spend money on treating the wastes from their industry. The advantage, therefore, to the community of regulations defining the degree of purity required in trade effluents can scarcely be over-estimated. Even the manufacturer himself, is usually benefitted by them as they preclude to a great extent, when properly complied with, risks of loss to him by litigation consequent upon his works, which might arise were such regulations not in force.

In the absence of such regulations the duty of the engineer is somewhat difficult. It is when called upon to design a sewerage scheme for an industrial plant to so lay out his scheme that the least possible nuisance may arise from the final effluent. It is, however, asking rather much of the engineer, employed by a manufacturer and in his interests, to do this in cases where statutory obligations may favor a cheaper but not so efficient design from the point of view of the purity of the final effluent. The conscientious engineer finds himself at a discount in such circumstances. The story of the cameleon may be familiar. The cameleon was placed on cloths of different colors and changed color quite successfully on each. Finaly he was laid on a piece of tartan. He wept salt tears and expired. In the words of the original teller of the story "He done his best but he busted." The engineer cannot be expected to serve two interests any more than could the victim of this story.

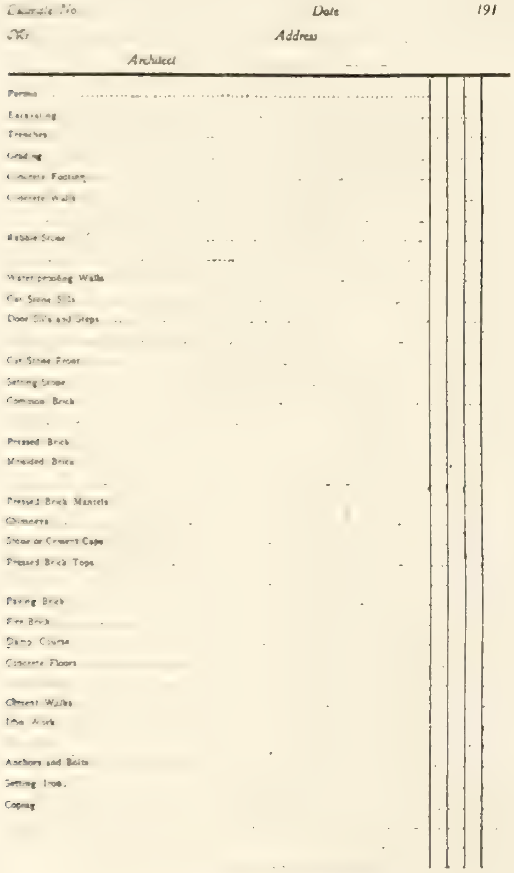
According to a despatch from Quebec, the City Council will seek power to purchase the Dorchester Electric Company at a cost of one million dollars. This is a steam plant, and supplies current for the electric lighting of the city.

Methods Which Make for Profit or Loss in Estimating

THERE are two stumbling blocks to the success of the average contractor, said a well-known builder of big buildings, recently, and many men are not aware of them. I allude to the estimator and the foreman.

If you will analyze a percentage of the failures of men in the contracting business you will find that about three-quarters of them are brought about by leaks, little or big, in the estimating department. The others can usually be traced directly to inefficient foremen.

This is a broad statement yet it is one that has a great deal of truth in it. In addition to the two stumbling blocks mentioned above another might be mentioned—the boss, himself, who through lack of personal supervision makes it possible for estimators to make costly mistakes and get away with them.



Contract No. Date 191
Mr Address
Architect

Permits
Excavating
Trenches
Grading
Concrete Footing
Concrete Walls
Rubble Stone
Waterproofing Walls
Cut Stone Sills
Door Sills and Steps
Cut Stone Front
Setting Stone
Common Brick
Pressed Brick
Moulded Brick
Pressed Brick Mantels
Chimneys
Stone or Cement Caps
Pressed Brick Tops
Paving Brick
Fire Brick
Damp Course
Concrete Floors
Cement Walks
Iron Work
Anchors and Bolts
Setting Iron
Coping

Fig. 1—Estimating blank used by a successful contractor for many years.

This estimating proposition is the weak spot in many other kinds of business as well as contracting. Take the average store keeper who runs behind until he really goes under, and you will find the main reason for his failure isn't so much lack of trade as it is loss of profit owing to carelessness in computing the difference between what goods cost and what they should be sold for; in other words he is a poor estimator.

Here is about the way the thing works. A man decides to go into the retail store business. He casts about for a location with the idea of starting in new with a fresh line of goods, or else, perhaps, he decides to buy someone out. After the location is secured he stocks up, unlocks the front door and awaits trade. Now the first thing any merchant ought to do is to figure out the exact cost of his goods, plus freight, plus rent, plus heat and light. To this he should add the depreciation on any stock not quickly sold and a percentage on goods slow to move. Once having the exact total cost of his goods it would seem easy to add the percentage of profit and establish a correct selling price. Many merchants make errors in their computations, however, and after they have been in business a while they are astonished to find that they are making no profit. Indeed, many discover when it is too late, that goods have been sold below cost and customers are getting the benefit of careless business methods.

Before any contractor can estimate intelligently he must first know the exact cost of his goods. Right here is the weakness in a good many offices. Cost prices are frequently made up from lists prepared a few years ago before wages and cost of materials went skyward. Or, often, contractors carelessly add to a former cost list the approximate percentage of increase; a computation that is frequently in error and set altogether too low.

Contractors themselves do not agree upon the best way to go at the estimating proposition. Many contractors, and successful ones, too, instead of figuring the net cost of work and then adding percentage of profit, simply figure every item, gross (cost plus profit); the total of all items added forming the sum of the complete bid.

Other contractors maintain that the only correct way is to take the net cost of each item, add these together and then add the percentage of profit. There are advantages to each system and no doubt exponents of each system will continue to do it their own particular way.

One advantage of the first mentioned method (gross cost system, including profit) is that it is a little less work to make such a bid. If brick-work is figured at, say $16.00 per thousand (which price includes price and profit) the total amount of the bid may be computed a little more quickly than when brick is figured at a net cost of, say $12 per thousand to which the contractor adds a profit of $4. Another advantage of this system lies in the fact that since many contractors have made bids for years based on gross costs, to begin making bids on a net cost system would involve rearranging their schedule of prices—quite a difficult job, of course.

One of the simplest estimate blanks I have seen is illustrated in Fig. 1. The contractor (who got it up for his own use) employs the gross cost method. When making a bid his estimator goes through plans and specifications, carefully computing the cost of each item.

These costs are based upon prices which his experience has taught are sufficiently high to pay the cost and yield him the percentage of profit he requires. Every item is filled out in the blank, and from the total figure resulting the contractor makes up his bid. The blank, being retained in the contractor's files for future reference, is not sent to the architect or owner. When the building is completed the estimator can compare the actual cost of the job with the estimated cost.

Right here let it be said that the estimator, himself, is one of the most important units in the contractor's machine for frequently the skill, prestige and capital of the contractor is discounted by the carelessness of an estimator whose low bid makes it impossible for the contractor to make any profit. On the other hand many a contractor has built up a good, profitable business by means of the accuracy and skill of his estimating department.

The prevailing weakness, inaccuracy, seems to be possible in any office, large or small. Now and then it is unpleasantly brought to the attention of the contractor who is suddenly shocked to find he has lost more money on one job than he can make up in half-a-dozen others. "Many contractors are dubs," said the general manager of a large concern to me, recently. "They deserve to lose. On our new factory contractors lost a hundred thousand dollars. Yesterday a friend of mine told me that a firm of contractors he employs lost heavily on three jobs they are just completing. Usually losses of this character are inexcusable, occurring most frequently on account of the indifference of contractors who are not sharp enough to check their estimators."

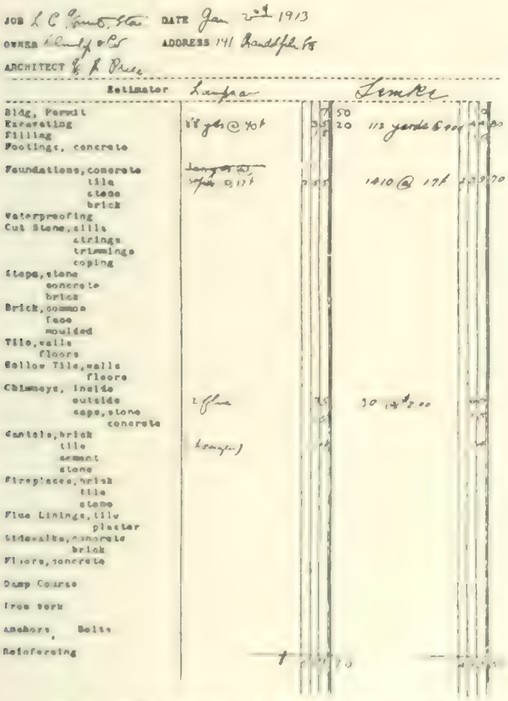

JOB [illegible] DATE Jan 2nd 1913
OWNER [illegible] ADDRESS 141 [illegible]
ARCHITECT [illegible]
Estimator [illegible] [illegible]
Bldg, Permit 50
Excavating 20
Filling
Footings, concrete
Foundations, concrete
tile 1410 @ 17¢
stone
brick
Waterproofing
Cut Stone, sills
strings
trimmings
coping
Steps, stone
concrete
brick
Brick, common
face
moulded
Tile, walls
floors
Hollow Tile, walls
floors
Chimneys, inside
outside
caps, stone
concrete
Mantels, brick
tile
cement
stone
Fireplaces, brick
tile
stone
Flue Linings, tile
plaster
Sidewalks, concrete
brick
Floors, concrete
Damp Course
Iron Work
Anchors, Bolts
Reinforcing

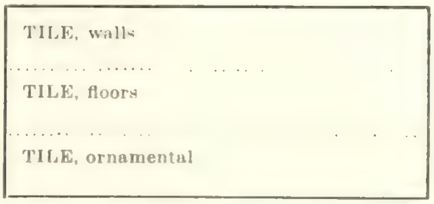
Fig. 2—Two estimators compare this blank, one checking the other.

"In our business," went on the general manager, "we can tell to the fraction of a cent what every article costs. We know the exact overhead charge for the entire plant including cost of buildings, machinery, insurance, depreciation, wages of heads of departments—in fact," he said emphatically, "it would be impossible for us to lose money on any of our merchandise unless we deliberately and knowingly decided to sell it below cost."

When contractors are willing to work out cost sheets in the same accurate way there will be fewer failures in the contracting business. There should not be guess work in figuring the cost of a building any more than there is in estimating the cost of merchandise. Every contractor who has an efficient working organization should be able to work a system of costs that would prove mistake proof."

As a matter of fact the contractor is up against a harder game in figuring costs than the manufacturer. You can compute how much work a machine will turn out but you cannot tell to a dollar how much work mechanics will produce, depending (as the computation will) upon weather, labor troubles, crankiness of architects or owner and numerous other noncontrollable conditions. Nevertheless, the careful estimator with complete cost lists should hit the result more accurately than is frequently the case.

Fig. 2 shows a new estimating blank called a "check system blank." The idea in using this form is to have two estimators figure on the same job, one checking the other. The first estimator fills out the items in the usual way after which he folds over the edge of the form to cover his figures. Then estimator No. 2 makes his own calculations without reference to the first list, after which he compares the two results. Any glaring discrepancies are instantly noticeable and such items should be computed again.


TILE, walls

TILE, floors

TILE, ornamental

Fig. 3—Perforated gummed sheets for pasting in estimate book.

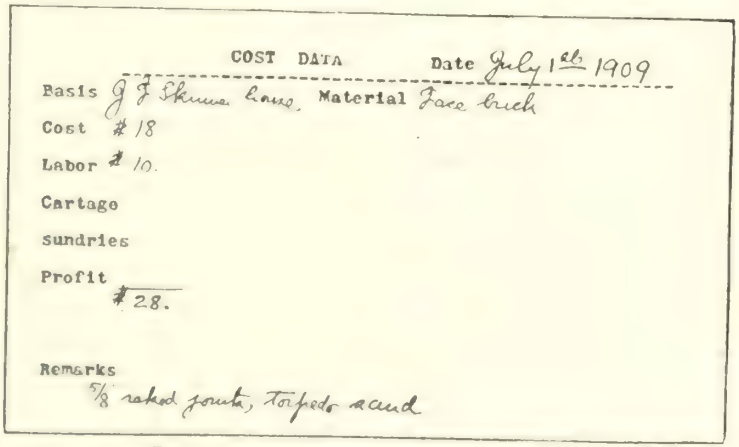

COST DATA Date July 1st 1909
Basis [illegible] Material Face brick
Cost $18
Labor $10.
Cartage
Sundries
Profit
$28.
Remarks
5/8 raked joints, Torpedo sand

Fig. 4—Loose leaf index card for tabulating costs.

The advantage of having a printed form for making out estimates is obvious. When contractors merely compute estimates in a blank book kept for the purpose they are liable to forget one or more items. With printed form covering every operation such items are less liable to be forgotten.

Another new idea recently advanced is to print the estimating blank on gummed and perforated paper. In making out an estimate, it is proposed to tear off from this sheet the items required in the estimate, pasting them in the estimate book (Fig. 3). For instance if the job is a small one containing only such items as "permit, excavating, stonework and brickwork," the corresponding headings would be filled out on the estimating blank, torn from the perforated sheet and pasted into the estimate book. Thus, reference to a sheet in the first place would act as a check against admitting any items, but there would be no long list of items left blank since only the items needed would be pasted in the book.

For keeping cost lists there are several methods open. A book can be used for this purpose, indexed for quick reference. On page set out for stock of brickwork, for instance, one can enter cost of common brick, cost of face brick, cost of wide joints, raked joints, and so on. Another good way is to employ a card index system of costs (Fig. 4). Cards are particularly desirable for new ones can be substituted as fast as prices change.

In filling out cost cards it is a good idea to have "material" and "labor" entered separately. In this way any fluctuation in labor or material can be readily altered on the card. As prices go up or down a record can be made so that when any estimating is done the estimator will have late prices to quote from.

No part of the contractor's equipment is more important than these cost sheets. They should be filed in a drawer or cabinet where they can be instantly referred to. It is an excellent idea to keep them under lock and key as more than one contractor has found out. Unscrupulous estimators, in a huff after being discharged, have been known to "go over to the enemy" with a complete copy of their former boss's cost lists; of immense advantage to a competitor.

It is surprising how indifferent to the importance of accurate estimating some contractors are. In one office I have known estimates to be made out by the office boy, who has been with the firm several months to be sure, but is hardly a good hand to "take off" quantities accurately. In other offices it seems to be the practice to shove laborious estimating off on the stenographer. Really, this job of estimating is important enough to be done by the boss himself. At least, if not done by him it should be attempted only by an expert, for no branch of the contracting business is more important nor in any office, large or small, immune from loss and eventual failure if the estimating department is not turning out accurate work.

Developments in Pumping Machinery

Contributed by Wm. Perry

IN the year 1641 a mechanic in Florence received an order to make for the Grand Duke a pump with a suction pipe extending between 50 and 60 feet between the valve and the level of the water. The pump was made and placed, but of course, when it was worked it raised no water. In the belief that the fact was due to some defect in the construction the maker was told to take it to pieces. This was done repeatedly, and new attempts were made to get the pump to perform the duty required. When nothing more could be done in this way the superintendent of the Grand Duke's water-works consulted Galileo, then eighty years old, blind and within a few weeks of death. The philosopher had never seen reason to doubt the truth of the opinion universally prevalent at the time that Nature "abhors a vacuum"; it was universally held that the power which raises water in pumps is some occult force, which, resisting all attempts to form a void, instantly presses water up the pipes when the air previously in them has been exhausted by the piston. When the whole circumstances of the difficulty at Florence were placed before Galileo he could only reply that Nature's abhorrence of a vacuum is limited and ceases to operate above the height of 33 feet. This opinion, given without opportunity for due examination, was probably not quite satisfactory to Galileo at the time. Within two years Torricelli, who lived with his family and assisted Galileo during the last three months of his life, was able to announce that this "occult force" was the pressure caused by the weight of the atmosphere.

This important fact he first established by an experiment as simple as it was ingenious and conclusive. He had made a model of the Grand Duke's pump, which had a suction pipe sixty feet long placed perpendicularly, with its lower end in the water. When the air at the top was exhausted, Torricelli found that he could by no means make the water rise more than 32 or 33 feet. He reduced the pipe to 40 feet, but without better success. It then occurred to the experimenter that if it were indeed the weight of the atmosphere which sustained the water in the pipe a substance other than water would rise to a height in the pipe exactly in proportion to the relative specific gravity of water and of the other substances employed. But a short time elapsed before this thought was submitted to the test of an experiment.

The medium employed was quicksilver, which is about 14 times heavier than water. When a vacuum was produced in the top of a tube, the lower part of which was filled with quicksilver open to the pressure of the atmosphere, it was at once seen that the column was supported at a height of only one-fourteenth that of the column of water. Quite a number of experiments have been made since. These have not shown any better results than those obtained by Torricelli.

I have had quite a wide experience in pumping machinery, going into the pump shop in 1851, and am the oldest pump expert in the Dominion today, and the best I ever did was at Chatham, N.B. When I had a vacuum of 27 inches I started the pump (a new one) and drew down to 30 feet, but I could not lift the water after stopping until the water raised in the well, 27 in. vacuum equals 30.62 feet.

Water is propelled through the suction pipe of a pump by the act of removing or lessening the pressure of the atmosphere on the surface of the water in the suction pipe. Properly speaking there is nothing in the operation resembling that of suction, one end of the pipe being placed in the water and the other end connected with the pump inlet, which is closed by a valve or valves. The stroke of the pump piston or plunger has the effect of partially removing the air in the pipe. The surface of the water being then relieved of a portion of the atmospheric pressure, there is less resistance offered to the water rising in the pipe. The water inside the suction pipe rises above the level of that outside in proportion to the extent to which the pressure of air is removed. If, for instance, the pressure of air within the suction is reduced by the first stroke from 14½ lbs. to 13½ lbs., the water will be forced up the pipe about 2¼ feet, because a column of water an inch square and 2¼ feet high is about equal to one pound in weight.

Upon the reduction of the pressure of the air contained in the suction from 14½ lbs. to 13½ lbs. per square inch, it is evident that unless the water ascended the pipe there would be an unequal pressure upon its surface inside and its surface outside the pipe. In consequence of the water rising 2¼ feet in the pipe the pressure upon the surface of the water, both inside and outside, is evenly balanced, as the pressure upon the water exposed to the full atmosphere is 14½ lbs. upon each square inch of its surface, while that upon the same planes, but within the pipe, will sustain a column of water 2¼ feet high (weighing 1 lb.) and 13½ lbs. pressure of air, making a total of 14½ lbs. If in consequence of a second stroke of the piston or plunger the air pressure in the pipe is reduced to 12½ lbs. per inch, water will rise another 2¼ feet. This rule is uniform.

The following table gives the velocity of flow through a suction pipe in feet per second with various heights—barometer 30, thermometer 60 deg. Fahr.

Height of pump in feet	Velocity of flow in pump chamber	Height of pump in feet	Velocity of flow in pump chamber
1	46.16	18	32.21
2	45.45	19	31.19
3	44.75	20	30.14
4	44.01	21	29.06
5	43.23	22	27.93
6	42.33	23	26.75
7	41.77	24	25.52
8	40.90	25	24.23
9	40.20	26	22.80
10	39.39	27	21.41
11	38.57	28	19.85
12	37.72	29	18.16
13	36.86	30	16.29
14	35.98	31	14.18
15	35.07	32	11.70
16	34.14	33	8.52
17	33.19	34	2.89

It will be seen that a pump will not raise with a velocity which is of practical value at a greater depth than 22 to 24 feet, and this is about the extreme limit of a pump's efficiency. Such heavy duty as this cannot be done except under the most favorable conditions. There is, however, hardly any limit to the length of horizontal suction pipe through which a pump will draw, provided both the pump and the joints are air-tight and the sizes are so proportioned as not to cause undue friction. I have put in a suction pipe 3,000 feet long, 16 ins. diameter, cast iron lead joints, and tested to 150 pounds pressure before covering in and another 750 feet long, 20 foot lift. What is most essential in a suction pipe is a vacuum chamber and where to place it. As a rule, pump manufacturers take too much for granted. They usually think that any one who purchases a steam pump understands how to connect it up properly. It is quite surprising, however, to find how few really know how to connect up a steam pump to get the best results, especially where the supply comes under a head. I usually take the trouble to follow up each case and see what the purchaser intends to do with the pump in the matter of piping and location and connections.

Regarding the use of suction chambers, I consider them of great importance when rightly placed on the suction pipe. I have what is called a Fire Engine used at the big fire in London, England, in 1666, and 12 copper plate engravings of fire engines invented by two brothers in Holland in 1630. The principle in connection with the inlet and outlet valves has not changed from that day to this and the copper plate engravings are not surpassed in any catalogue today. They did not have hose or suction pipes, but they did good work, which is shown on the different engravings.

Protection of Unfinished Concrete

THE use of concrete during the winter months has always been attended with more or less danger, and opinions are divided as to the advisability of placing concrete in freezing weather. Mr. Leonard C. Wason, president of the Aberthaw Construction Company of Boston, Mass., in a recent paper read before the Boston Society of Civil Engineers, gives a number of interesting items which he has found during his experience in that line. It seems to be generally considered that the concrete laid in the winter months will be exactly as good as that in the summer, and possibly more so, if the necessary precautions to protect it are taken.

The aggregates must be free from fost when mixed. A live steam pipe should be shoved into the sand pile, the escaping steam heating it and removing all frost. The same may be done with the stone, but a canvas should be thrown over the top of the pile to retain the heat, which more readily escapes. When a considerable amount of heating is provided for in advance, steam pipes are laid on the ground, and stone as received is dumped upon them. Then there is a canvas thrown over to prevent storms getting into the pile and to retain the heat. The frost is thus easily and economically removed.

Salt is frequently used in the water to lower its freezing point. It is seldom worth while to heat the water itself. Little care need be used to prevent mass concrete from freezing, as the frost will usually only strike to a depth of about one inch. Buildings are inclosed with tarpaulin tied onto an outside staging, and the inclosed space is heated with salamanders burning coke. Sometimes it is possible to use steam.

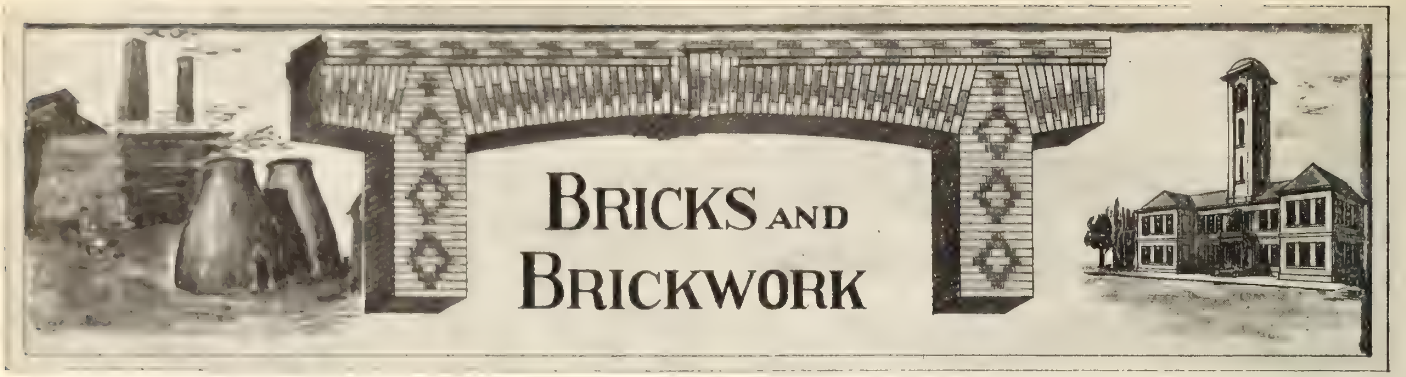
Frost is removed from work by the use of salt and steam, and if the concrete surface is left rough it is common to sprinkle the top surface with salt to prevent freezing. In winter it is very common to put the finish on as a separate operation, after the building is enclosed, and not as an integral part of the construction, on account of the danger of freezing. After it is put on, it must be kept from freezing for the first forty-eight hours.

The expense of protection against the weather is not very great, and good results can be so surely guaranteed that it is not usual to discontinue work on account of cold weather.

Occasionally it is necessary to make some provision for the protection of the men. Shelters or wind shields are built in front of the benches where carpenters are making up forms, as well are around the men at the concrete mixer, whose work does not necessarily keep them warm. Where excavation is going on in the open, it is expedient to have a building with a good fire, where the men can warm themselves when necessary; and on a few jobs it has proved to be wise to provide hot coffee free in these shelters.

The greatest iron-ore producer in the United States is Minnesota, by a wide margin, according to a bulletin issued by the U. S. Geological Survey. In 1913 the total marketed production in the country was 59,643,098 long tons, valued at $130,905,558, of which Minnesota contributed 36,603,331 tons, valued at $80,789,025. In 1912 Minnesota produced 34,249,813 tons valued at $61,905,017.

In pursuance of the policy of double tracking the principal lines, the C. P. R. are constructing a new double track bridge over the Lachine Canal, P. Q.



The Possibilities of Brick in an Educational Exhibit

THE possibilities of brick are well illustrated in the accompanying views of brick exhibit rooms. As a matter of fact, no illustration can do justice to the great variety of rich, soft color tones here displayed in buffs, greys and reds, finished in rough and smooth textures and enamel. Adequate color reproduction is unsatisfactory and the black and white print is the best available. But even at that, the photographs are sufficiently illuminating as to the possibilities of brick in the work of educating the public to the best use of constructional materials.

Such exhibit rooms as these, and that of the Don Valley Brick Company, Toronto (which we hope to illustrate in a later issue), suggest that manufacturers are awakening to the advantages of putting material proof behind their selling arguments. With no other single material of construction can such artistic effects be produced. A brick wall built up of many units, each carefully laid in place, expresses individuality and character impossible to obtain with any other building material. This is axiomatic: even the cement man will admit that it is beyond dispute. It has been said that the brick wall is to the cement surface or a painted wooden surface as an Oriental rug is to a single colored carpet or as an oil painting is to a chromo. During the last few years so many excellent uses have been found for cement and so many advantages have been discovered for it, particularly in all forms of engineering work, that there has been a popular tendency to side-track the oldest and most honorable material of them all.

Professor Gillespie, of the University of Toronto, is well known as an expert on cement and concrete, but his attitude towards brick is proved by the opening paragraph of an article entitled, "Brick Masonry in the Light of Recent Tests," which he contributed a few years ago to one of the special numbers of this journal. Therein he wrote:

"Begun in prehistoric days, when primitive man fashioned the clay and baked it in the sun; developed and improved with the accumulated experience of succeeding ages and perfected in recent times through the investigations of the ceramist and the chemist, the brick-maker's art commands a respect and possesses a prestige analogous to that which attaches to an old and honorable family."

Brick has withstood the ravages of time for thousands of years. . Brick walls built by the Babylonians three thousand years before Christ are still standing in good condition, while others built of competitive material, erected only half the time, have crumbled to dust. Brick has been known and recognized in every age. From the sun-dried clay of the early Babylonians down to the latest product of the best of our Canadian and American factories, the two outstanding characteristics of the material that have never been disputed have been Permanency and Variety.

Brick improves with age and its value does not deteriorate. The Hy-tex people quote a case in point: "In a large mid-Western city are two houses side by side, built at the same time some years ago by two brothers. Both are of simple and rather commonplace architectural design. The more substantial and dignified appearance of the brick house seems due to the brick alone; the main difference in the floor plans and designs is that the frame house is larger. The first cost of the brick house was slightly greater, but—the frame house was sold recently,—and it was no forced sale either—at a loss of 40 per cent. of its original cost; while for the brick house, standing on the next adjoining lot, recent bidders have offered twice its original cost."

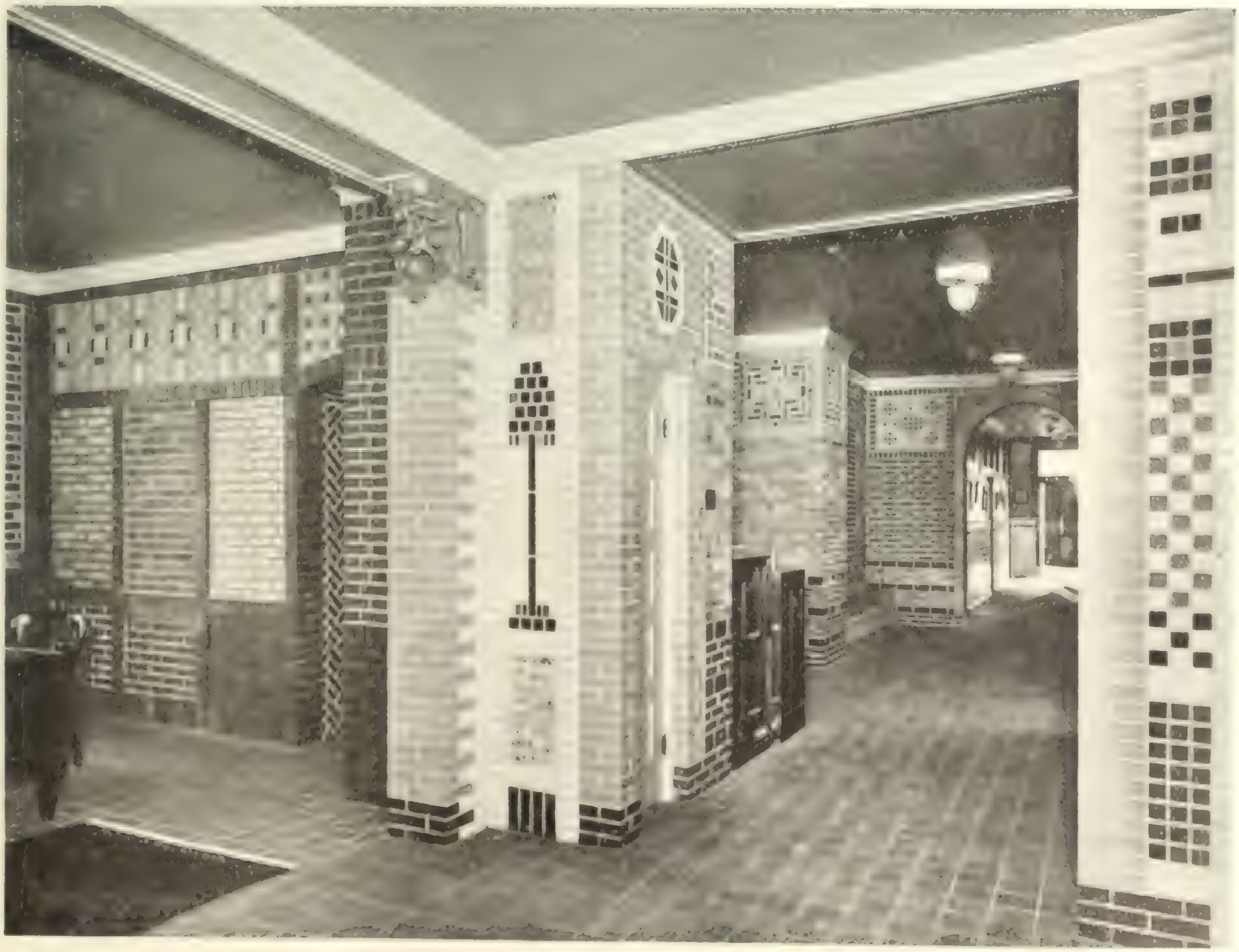
A point that may well be impressed upon all users of constructional material is that first cost is only one of the many elements that enter into genuine economy. In the construction of a residence it may be possible to effect a saving of several hundred dollars by substituting cheaper material for brick, but the principal and interest on the additional amount are soon made up. An interesting illustration of the place occupied by brick in comparative costs is contained in the booklet "Genuine Economy in Home Building" (Hydraulic-Press Brick Company). In this booklet attention is directed to a view of a residence completed recently at St. Louis. This house has 13-in. solid brick walls and is faced all around with Hy-tex brick. We extract the following from the booklet:

"This house is built very substantially, with tile roof, copper gutters, cut stone sills and trim. All the details are such as a purse-free home-builder desires. To build the house complete cost $9,875. We have on file the itemized price-sheets and contract bids.

"To obtain definite, unprejudiced, up-to-date figures on comparative costs, we had the blue-print plans of the house re-figured by one of the most careful contractors in St. Louis, as if the outside walls were to be of frame instead of brick. Our frame specifications assumed that all other items except outside walls remained the same. We were not content with the estimated price; we secured a contract bid for which the contractor could be held to take the job. The contract price of brickwork, both material and labor, on

The views reproduced herewith are of the exhibit rooms of the Hydraulic-Press Brick Company at St. Louis. On the left is shown a glimpse of a corridor; on the right a Dutch fireplace; and below, the main hallway and piers. The great variety of rich, soft color-tones here displayed in buffs, grays and reds finished in rough and smooth texture and enamel, make adequate color reproduction unsatisfactory.

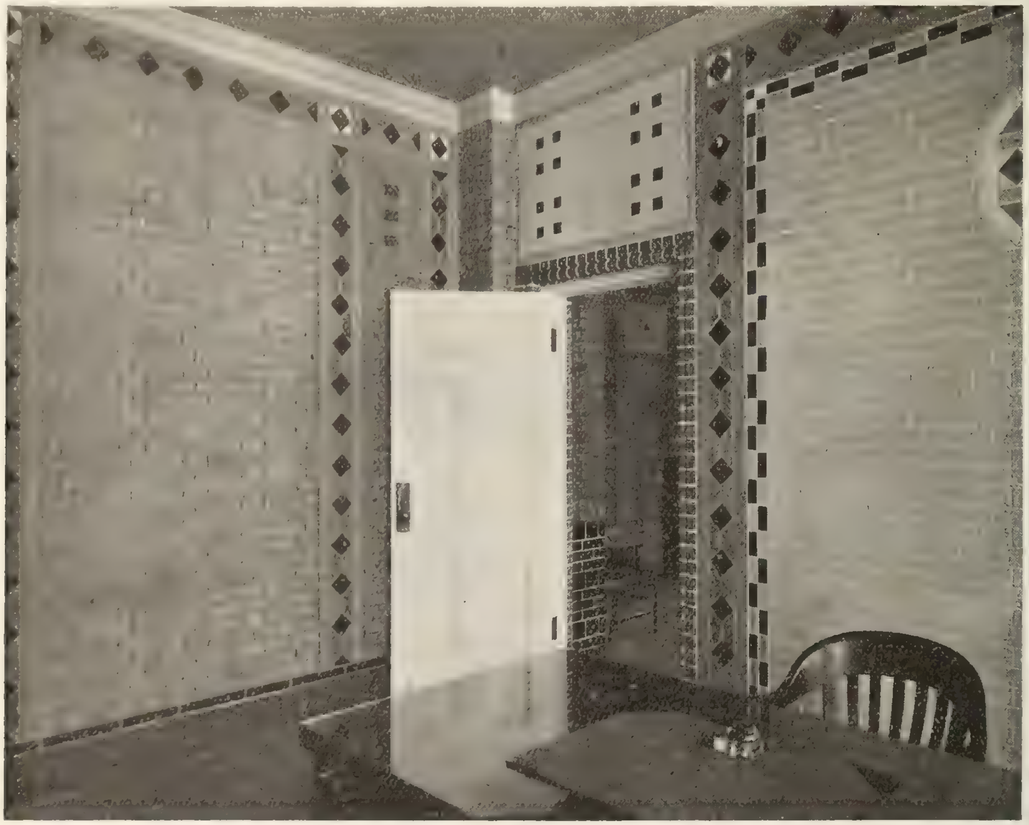
THE POSSIBILITIES OF BRICK



this house as actually charged was $1,465. The contractor's bid for frame construction on the same house was $1,137.71, a difference of $327.29. To this, in all fairness, should be added the cost of the cut stone used in the brick house for window sills, around the porch, and for trim, $102, increasing the total difference in favor of frame to $429.29.

"Then we sent photographs and blue-print plans of the same home to our office managers in Philadelphia, Cleveland, Indianapolis, Omaha and Minneapolis. They in turn secured from prominent residence contractors in their cities actual bids, not estimates, for solid brick and for frame outer walls, just as we had done in St. Louis. These cities are fair representatives of building costs, both in material and labor, for the nation, and the results obtained are of timely value to every prospective home-builder.

"Next to the St. Louis figures, Indianapolis showed the lowest difference in favor of frame, with $610.19. Omaha followed close, with the brick walls more expensive by $671.27. Philadelphia and Cleveland were next in order with $755.02 and $771.70 respectively. In Minneapolis, whose early fortunes were built on timber, the difference in favor of frame was $855. For these six representative cities, the average difference in first cost between brick and frame construction was $682.08.


The Gray Room in the offices of the Hydraulic-Press Brick Company.

"Thus we see that even where frame is cheaper the saving effected by its use is only 8.6 per cent. of the cost of brick. Where the difference is least, brick cost only 4.4 per cent. more. The average difference in the contract bids of the six cities was 6.9 per cent.

"While we also called for contract bids from several cities on other forms of construction, we will not take space to quote them here. These other forms, such as stucco or cement siding, brick veneer, either on frame or on hollow tile, and 9-inch brick walls, all lie between the two extremes which we have itemized. Reinforced concrete and natural stone are both considerably more costly than the most expensive form of brick construction."

In conclusion, one can only point again to the admirable work which we have attempted to illustrate in these pages as a proof of what can be done and what is being done with brick. More of this kind of work is necessary. If brick manufacturers put more life into their trade and exert themselves more in the way of providing additional facilities for the public they will reap a richer harvest than they have done. Brick, of all materials, lends itself to skilful use and arrangement in the exhibit room. Let us hope, then, that such facilities will be increased and improved upon until it becomes a matter of pleasure and education to call in and see the brick manufacturer.

The largest chain-drive transmission in the world is said to be that of the Ox-Bow hydro-electric plant on the Snake River at Copperfield, Ore. The installation consists of one 3,600 kw., three-phase, 60-cycle generator, running at 225 r.p.m., operated by two water-wheel units. Each of these units consists of two pairs of water wheels of the horizontal type, with 48-in. centre discharge, set in open flume, and operating at 21 ft. head and 147 r.p.m. The water is supplied through a tunnel cutting off a bend in the river. Each water-wheel unit is connected to the generator by four Morse chains 21 ins. wide, with sprockets of 2-in. pitch on the line shafting, and with shaft centres 10 ft. apart. The generator shaft is in the centre and 5 ft. above the level of the water-wheel shafts. This chain drive is said to be three times greater in size than any previously built, the largest one previous to this being at Indianapolis, Ind., and driving a 1,200 h.p. generator. The Ox-Bow plant was designed originally to operate under a 45-ft. head obtained by a natural fall of 21 ft. by the tunnel through the bend in Snake River, and the building of a diversion dam across the river below the tunnel. Both the water-power and electrical machinery were purchased for this head, but due to financial troubles the company was unable to build the dam and for four years the property lay idle. The plant was put in operation on September 30. It was designed by the W. H. Rosecrans Engineering Company, of Chicago.

A Discussion of Building-Factor Costs

By Harold L. Green, in the Engineering Magazine

"No one at the present time can say what is a standard buildings factor proper to a machine shop, a foundry, or a rolling mill, and this implies that no one is in a position to say that this or that particular instance is an example of efficiency when it is discovered." This interesting statement appears in a well known book on cost accounting.*

It has been my privilege to develop burden charges in several large industrial plants during the last two years. The development of a buildings-factor, which should include all the expenses attendant upon the ownership, use, and occupancy of a building, and which should be expressed in terms of an annual charge per square foot of floor space in the building, was a necessary part of this work.

Although an explanation of how these buildings-factor costs were determined and what the costs were found to be in several industries would not set up absolute standards of efficiency, such data would enable relative comparisons to be made, and would serve as a basis for studying the elements of buildings-factor costs with the object in view of approaching a maximum efficiency.

Therefore it is the purpose of this article to state the elements of the buildings-factor costs as determined by the writer; to describe how the costs were obtained; to state the average cost of these elements as found in a large number of specific cases; and to draw brief conclusions, based on the above results, as to how an efficient land-and-buildings factor may be attained.

There is no fixed set of elements making up a land-and-buildings factor. In the majority of cases, however, the elements discussed in this article will include all the costs making up a complete factor for the purpose of a square-foot distribution to departments or production centres as the cost-accounting practice may require. Thus the elements which have been selected are almost universal, while those particular to special industries are not considered. Following is a classification of these elements together with an explanation of how the cost of each was determined: 1. Fixed charges on land; 2. Fixed charges on buildings; 3. Fixed charges on buildings fixtures; 4. Power and light; 5. Heat; 6. Building expense.

Fixed charges consist of interest, taxes, insurance, depreciation, and repairs, and are calculated as a percentage of the appraisal value of the land, buildings, and fixtures. The interest rate was taken at 5 per cent. in all cases. Tax and insurance rates were determined for each particular case. These rates were quite uniform, however, and 1 per cent. for taxes and ½ of 1 per cent. for insurance would be fair averages. On buildings the rates for depreciation and repairs averaged 2 per cent. and 3 per cent. respectively, while for buildings fixtures, which consist of steam and water piping, electric-light wiring, elevators, sprinkler systems, etc., rates of 5 per cent. for depreciation and 5 per cent. for repairs were used.

For convenience these rates are summarized in the following table:

	Land. per cent.	Buildings. per cent.	Fixtures. per cent.
Interest	5	5	5
Taxes	1	1	1
Insurance	..	.5	.5
Depreciation	..	2	5
Repairs	..	3	5
Total	6	11.5	16.5

It is evident that correct interest, tax, and insurance rates can be determined. Correct reserves for depreciation and repairs are open to considerable discussion, however, and the correct reserves will vary with the type of buildings under consideration. As a basis for this article, about twenty-five mill-construction buildings used for paper, textile, and machine-building industries, and costing from $1.25 to $1.50 per square foot, have been selected. The rates given above for depreciation and repairs were used in these mills, and appear to be correct, judging from accumulated cost-accounting records.

The cost of the first three elements—fixed charges on land, buildings, and fixtures—was determined then by calculating proper annual interest, tax, insurance, depreciation, and repair charges as a percentage of the appraisal value of the land, buildings, and fixtures.

The next two elements (power, heat, and light) include the cost of power used for lighting buildings and operating elevators, and the cost of steam used for heating. These costs are, of course, based on a determination of how much power and heat is used for these purposes, and how much it costs to make the power and steam in the particular plant.

The amount of steam used for heating was estimated theoretically by the same methods which would be used in designing a heating system for a mill building, and these theoretical results were checked with the known difference in coal consumption between winter and summer months due to heating. Power used for lighting was frequently developed by a separate generator, which enabled a log of switchboard readings to be used in making this determination. In a few cases power for lighting was purchased. Power used by elevators is, in most cases, a relatively small item and depends on the size of the elevators and the frequency with which they are used.

In determining the cost of the steam and power used, fixed charges on land, buildings, fixtures, and equipment, as well as operating charges for fuel, labor, supplies, etc., are included. In the several plants under discussion the average cost of steam was [illegible] cents per 1,000 pounds, and of power was 2 cents per kilowatt hour. The cost of power, heat, and light was determined then by estimating the power, heat, and light used, and calculating the cost, taking into consideration the cost of power at the plant in question.

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* Production Factors in Cost Accounting and Works Management. By A. Hamilton Church.

The last element, buildings expense, is made up of expense items attendant upon the operation of practically all factory buildings. Under this head has been included labor, such as watchmen, elevator operators, janitors, etc., and the cost of supplies used for cleaning buildings, the cost of water for general factory use, and other similar items.

An attempt has been made in the preceding paragraphs to describe definitely how the total land and buildings factor has been determined. If this has been done, the data following should have a practical value for comparative purposes, and this discussion should serve as a basis for a study of buildings-factor costs with the object in view of approaching a maximum efficiency.

The average cost of a square foot of floor space, in the buildings as explained in the previous paragraphs of this article, was 22 cents. As an illustration of the meaning of this cost, take the case of a boring mill in a machine shop which may occupy a space 20 feet by 20 feet, when allowance is made for the machine, the operator, and the necessary movement of work at the machine. A square-foot factor or buildings factor of say 25 cents would mean that it costs 20 x 20 x 25 cents, or $100 a year to house this machine. Assuming a working time of 2,500 hours a year, it would mean that this cost accumulates at a rate of 4 cents an hour. This buildings-factor charge is an appreciable percentage of the wages paid the machine operator, and is but one of several equally important factors making up the total burden of the industry.

Relatively, the buildings-factor charge was found to be divided between the elements as shown in the next column:

Division of a Typical Buildings-Factor Charge

		Per cent.	Cents.
1.	Fixed charges on land	10	2.2
2.	Fixed charges on buildings	56	12.3
3.	Fixed charges on buildings fixtures	9	2.0
4.	Power and light	4	.9
5.	Heat	14	3.1
6.	Buildings expense	7	1.5
	Total	100	22.0

From a study of buildings-factor charges in a large number of plants, the percentages and costs given above have been selected as being those which are attained in average practice. If, in a given plant, any of the above elements are materially greater than the averages shown above, the reason should be at once apparent. The factory site may be on valuable land, the buildings may be of an expensive design, heating and lighting systems may be inefficient, and items chargeable to buildings expense may need investigation.

By far the most important item is that of fixed charges on buildings. The selection of good building materials when making repairs or additions offers an opportunity for a reduction in depreciation and repair charges, which cause about half of this expense. The amount of interest charged to cost will be increased, but the savings in depreciation and repair charges will usually compare very favorably with this amount. Interest and tax charges on land may be decreased by the selection of a cheaper site, and there are many cities offering such locations to desirable industries at the present time. Insurance charges may be lowered by making a few changes in fire-protection equipment, and by insuring with mutual companies, with whom very low rates may be secured.

And after building site and building materials have been selected, and each of the fixed charges lowered as much as possible, the building designed to give the greatest amount of floor space for a given cost will reduce the buildings factor greatly. Or if it is desired to erect a new building to provide a definite amount of space, it is well known that it will be much cheaper to construct a wide building four storeys high than to attempt to get the same amount of space in a one or two-storey building covering a much larger ground area. All the above considerations affect the resultant buildings factor, and the cost per hour of housing every machine in the plant.

Lighting and heating-system costs can be checked also. If lighting costs are high, the equipment may be at fault, lights may be poorly placed, they may be of a design which takes more power than a better lamp would need, or the cost of the power itself may be too high. Excessive heating costs may show that the design of the system is at fault in respect to the location of heating surfaces, the needless exposure of heating surfaces to outside tempeartures, the disposition of returns from the system, the methods of circulation, etc., or again the cost of the steam itself may be too much.

A reduction in buildings expense may be secured by an investigation as to the necessity, or as to the economy of use, of the items going to make up this element.

In conclusion, then, the organization that can secure a cheap site, that can occupy buildings of good construction and of economical design, that can install efficient heating and lighting apparatus, and that can provide for the proper care-taking of their property, will have the lowest buildings-factor charge, and will have made an important step toward a maximum efficiency in one of the largest factors making up the burden of an industrial organization.

High-Alloy Steel for Bridges

High-alloy steels for bridges have been discussed at some length by J. A. L. Waddell in a paper presented before the American Society of Civil Engineers. In closing the discussion on this paper, in the "Proceedings" of the Society for October, 1914, Mr. Waddell gives the following conclusions:

1. Titanium as a scavenger of carbon steel promises good and useful results at exceedingly low cost. Although it does not increase greatly the elastic limit or the ultimate strength of the metal, it makes it much more uniform and reliable. On this account it should be used in a few cases on bridge work; and then, if it be found satisfactory, its adoption should be made obligatory by railway companies and other builders of carbon-steel bridges.

2. There appear to be great possibilities in the use of aluminium as an alloy for bridge steel. But, very few experiments in aluminium steels have yet been made; hence, the possibilities are more or less hypothetical.

3. The possibility of obtaining a good, high-alloy steel for bridges by the use of vanadium appears to be a settled fact. But the highest elastic limit and ultimate strength which can be obtained on a commercial basis by the use of that element cannot be determined without elaborate and exhaustive experiments.

A committee of the Montreal Builders' Exchange has been appointed to ask the council to pass a by-law by which the city will be able to accept guarantee bonds or bid bonds in lieu of a cash deposit or a marked cheque, at the option of the tenderer, in submitting a bid for municipal contracts.

The Contractor and Engineering Problems in the Home

By Chas. F. Smith

ONE may have a house of elaborate design, architecturally a thing of beauty; a glorious addition to the landscape; the interior artistically furnished; but, if the plumbing, heating and lighting equipments are faulty the house remains unsatisfactory and loses its charming title of "home" to the occupants, and becomes merely an uncomfortable residence. It may also be absolutely dangerous to health and life from defective plumbing or heating, and seriously impair the health of the occupants by improper illumination.

It behoves the contractor, therefore, to thoroughly acquaint himself with the different systems of heating and lighting, and the methods and materials to be employed to insure the installation of sanitary plumbing, heating, and lighting equipments, in order that he may not only satisfy the owner of the building he is erecting, but satisfy himself as well, that all has been done that lay in his power to safeguard the occupants from any improper or imperfect installation.

Many contractors are content to go on year after year duplicating the heating or plumbing equipment in every house they build, principally because they have some "friend in the business" who can install the plant at a reasonable price, and they fail to give the efficiency of the plant a thought, nor do they care much whether there is anything better to be had or not.

The "friend in the business" may be honest enough in his intentions to give good value for the money received, but he, too, is likely to be shortsighted and adhere too closely to old deals and customs, ignoring, entirely, improvements in apparatus and methods, no doubt more from ignorance that any exist, because of his lack of ambition to acquaint himself with modern methods, than from any real desire to adhere so closely to venerable systems.

Many manufacturers state with absorbing pride that their productions have been on the market thirty or forty years. That is all very well so far as it goes, and it does indicate a more or less successful business and the ability to keep alive; but, as a matter of fact, if no improvements have been made in their productions during the past ten years they are out of date and lag far behind in the race for real success. The world is moving swiftly to-day, and wonderful improvements are being made in all lines of human endeavor, and in none greater than in the building line and all that pertains to it; consequently the contractor who desires to keep up with the times must post himself thoroughly on all the changes and improvements in the business, and maintain a compelte list of catalogues for the benefit of himself and his clients.

There is no part of the equipment of a building, new or old, which is of greater importance than the plumbing. The health, and even life itself, depends in a great measure upon the efficiency of the plumbing. A small leak in the piping, a defective trap to any of the fixtures, or a fixture itself which accumulates foul matter and is not readily cleaned becomes a very serious menace to the health of the occupants of the building by the admission or culture of typhoid and malarial germs. The greatest care should be exercised in the erection of the piping, which should be only of extra heavy cast-iron pipe, uncoated, or galvanized wrought iron, clear of any obstructions, and free from any defects, cracks, blow holes, etc.; the cast-iron pipe securely caulked with picked oakum and pure lead to make a good tight joint; very little lead pipe should be used—it is liable to be punctured by nails during erection, or by rats and mice afterwards, and in the case of water pipes is sometimes dangerous, as some waters absorb lead in sufficient quantities to eventually become poisonous, lead being a cumulative poison. No one to-day with the least pretentions to advancement would consider resorting to the old unsightly and unsanitary privy vault, which of course can only be used in country districts anyway, where there are no sewers. In such cases the best substitute where one has running water in the house is the septic tank, which treats the sewage without chemicals. The effluent passing through a filter bed is odorless and harmless, and the entire system requires practically no attenton.

Another very good system, in use where water is not available, is a chemical system, using a tank somewhat similar to a septic tank, except that there is no overflow; no filter bed and no water is used with it, the tank being charged with a chemical which disintegrates the solid matter and destroys the germs and foul odors. The tank is pumped out at long intervals and recharged. A porcelain bowl or toilet is furnished with this system.

Both systems give entire satisfaction, are thoroughly sanitary, inexpensive to install or maintain, and are certainly a great boom to the suburban or country districts.

Usually in the town or city where sewers are provided, a sewer connection for each house is compulsory; but the sewage disposal of the city is rapidly becoming a very serious problem. The present plan in the great majority of cases is to have the sewers discharge into a lake or river, or, at the seaboard, into the ocean; but this plan is having the very natural result of polluting our navigable waters to so great an extent as to become positively dangerous to the health of our cities. It is a question if, after all, the answer may not be the use by each house of an individual septic or chemical tank as above described, the harmless effluent then being discharged into the sewer, the sludge when of sufficient quantity being removed separately and otherwise disposed of. It would not be the first important problem solved by the rural district.

Having decided upon our system of sewage disposal, the plumbing fixtures must claim our attention. Generally speaking, all porcelain toilets or water closets look very much alike to the owner of the house and often to the builder as well; there is a difference, but more in the type than in the construction or finish. The one type to be adjured, regardless of price, is the so-called washout closet either front or back connection; the water seal is shallow and easily broken, admitting the foul gases to the house; there is never sufficient depth of water in the bowl to cover the soil, and it is rarely indeed that the bowl is cleared by one flushing; in fact, it is an unsanitary closet in all [illegible] spects, and its use should be prohibited. The other types, wash down or syphon jet, as made by any of the manufacturers, are reliable and sanitary, and cost very little more for the same finish than the objectionable "washout." It should be remembered that, where a chemical sewage tank is used the water closets just mentioned cannot be used, as a special closet is provided by the manufacturers of that system. To be really sanitary kitchen sinks and lavatories should be in one piece, and either galvanized or porcelain lined, the latter of course preferred; there is then no chance for the accumulation of foul matter in the joints, as there is with made-up fixtures.

There is nothing more attractive as a bath in our modern home than the porcelain-lined tub; but wth it should also go a nickel-plated shower with a mixing column to secure the right temperature of water; one may rinse off well and obtain the best results from the bath.

It is not often that a builder will have a client or owner who knows just exactly what he wants and is able to specify it. In nearly all cases the contractor is expected and desired to make suggestions to his client regarding various features and conveniences desirable to include in the house, and there is surely no convenience of greater importance than an abundant supply of hot water on tap at all times during the winter months, with a good fire in the range at all times, and another in the furnace or boiler which can also be used for that purpose if desired, it is an easy matter to have plenty of hot water, but in the summer, when the fires are out, or the range in use only occasionally, it is different; and at such times, or even at night during the winter when the fires are banked, the automatic gas heater is of very great service. It is assumed, of course, that gas is to be in the house—either city gas, acetylene, or gasoline gas in some form; the heater is automatic in either case, and after being once lighted requires no further attention. Can a greater convenience be imagined? Nothing but the pilot light burning, so small as to be scarcely discernible. Turn on a faucet in any part of the house, and immediately the flame is on full blast, and we have hot water. It is always better to use a heater with a double coil. The first cost may be greater but it is more economical in operation.

There is no excuse for a lack of conveniences even when remodelling an old house, as they are all easily installed, and improvements in methods and manufacture have brought the prices of the various appliances down within the reach of every one able to own a house; it resolves itself merely into deciding what particular appliance to select.

One appliance, perfected only during the last few years, and yet needed ever since coal has been in use, is the modern coal chute; the most approved form is provided with a hinged cover which opens up against the house, to protect the latter from being defaced when the coal is shovelled in. The cover is of glass, in a metal frame, and may be securely locked from the inside; it should also be provided with side plates. It should be located in a position that will deposit the coal conveniently to the furnace and also be accessible to the kitchen range.

The open replace is very much in vogue just now in the living room, and in many cases in the dining room also; in fact, it amounts almost to a renaissance of colonial days. They are so attractiv as to be almost irresistible, but for heating the room they are sadly inefficient, and need to be supplemented by some other method; although they do add very materially to the ventilation, provided the chimney damper does not close so tightly as to throw the smoke and gases into the room, as it then becomes positively dangerous. However, by the use of the improved damper mechanism for the fireplace, this trouble cannot occur, as the damper is controlled by a mechanism which renders the fireplace far more efficient than formerly by permitting better control of the fire, with less loss of heat.

Where the winters are not too severe the hot air system of heating with the furnace is satisfactory, and it provides better ventilation than either steam or hot water; but the furnace must be of ample size for the work, and provided with large radiating surface; and the cold air duct should extend clear across the house, wth an inlet at each end controlled by light cloth flap valves and a cut-off damper. A mistake made by many people operating a furnace is to close the cold air damper in very cold weather to keep the cold air out, when, in fact, they should do just the opposite, as additional heat with the furnace can only be obtained by the admission of a larger volume of air. There are many excellent furnaces in the market to-day, of cast-iron, steel, or galvanized iron, portable or brick set; but any one should contain a large, deep fire pot, as this is the very life of the system, be accessible for cleaning, and also contain a water pan of very liberal area, because if the air is not moistened when passing through the furnace the furniture and wood work about the house will be dried out and crack, and the occupants of the house wlll feel as though they were living in the Desert of Sahara.

There are some advantages in hot-water heating over steam heating. It is easily controlled and has a greater range than the steam system. It is not often that the full power of the plant is required; most of the time only a moderate heat is required, and then the water system has the advantage; but the radiation must be ample for the most extreme cases, and, as the temperature of the water is not so high as the steam, the initial cost of the installation is higher because more radiation is required.

There are systems of steam heating in use now which require only atmospheric pressure for complete circulation, keeping the temperature down to 212 degrees, and permitting close regulation at each radiator of the heat required. There are also governors, or automatic controllers with a time clock attachment which can be set to open the draft of furnace or boiler at any hour of the morning, assuring a warm house at getting-up time, and they also control the draft during the day, insuring close and economical regulation of the fire.

There are many different makes of steam and hot-water heating boilers, of steel and cast iron, the latter of the sectional type, with underfeed, hopper feed, and plain shovel feed; the underfeed is economical in operation, and can use a cheaper grade of fuel than the others, and is likely to be smokeless when burning soft coal if properly handled.

In all cases with a steam boiler it is advisable to get one with a low water line to insure better circulation with the lower radiators.

Any of the manufacturers, if furnished with a sketch of the floor plans, giving the heights and other dimensions together with location and size of windows, will gladly supply complete heating plans, with an estimate of the cost of installation, and be willing to guarantee results if their plans are followed.

The modern house is not complete without modern lighting. If it is located in the city or town where gas and electricity are available it is an easy matter to have both, but where neither is available from a town supply, it becomes necessary to have an isolated plant of some kind. The electric plant operated by a gasoline engine is compact, convenient and easy to handle. Unless, however, the house is an unusually large one, or on a farm where some power can be utilized, it is not so desirable as a gas plant.

Some of the gasoline generators are operated by a weight which needs to be wound up at intervals, others by passing heated air over the gasoline. Both types are automatic and require very little attention. The weighted type is the larger and more dependable.

The acetylene is generated by dripping carbide into water, or water on to carbide, the former being the better method. Many different types and styles of generators are in the market, operating both ways. Undoubtedly acetylene is the safest, and, generally speaking, the most satisfactory illuminating gas we have, it being about as economical as any in cost of installation and operation when the illumination in candle power is considered.—National Builder.

New Street Lighting System at Outremont

A new street lighting system, designed by Dr. L. A. Herdt, of McGill University, has just been put into operation by the town of Outremont, P.Q., the first Canadian city or town to have its entire street lighting served by underground cables. The lamps are of the 6.6 ampere nitrogen-filled tungsten incandescent type. The power is supplied in bulk at 2,200 volts to a sub-station and transformed with 25 kv.a. 2-circuit constant current regulators. The town is wired for ten separate circuits supplied from five regulators, the circuits being arranged so that damage to a regulator will only affect two small areas at different parts of the town, and will not disturb the entire system. The total number of lamps is 498, and approximately two miles of streets are illuminated. There are two sizes of lamp—a 400 candle power on streets where there are tramway car tracks and a 250 candle power on other thoroughfares. The lamp standards are of the bracket type, and on the tramways route a combination pole is used to allow of the attachment of the trolley span wires. The standards are spaced 200 feet apart on one side of the street, and the same distance on both sides on the tramways route. All the equipment is of Canadian manufacture, the total cost being about $75,000. Mr. Duchastel, the town engineer, supervised the installation. The standards were made by the William Hamilton Company, Peterborough, Ont., while the 6,600 volt rubber-covered cable for the standards and the nitrogen-filled tungsten lamps were supplied by the Northern Electric Company, Montreal.

It has been decided to commence work on the construction of the aqueduct for the Greater Winnipeg Water District early next March. Excellent progress has been made on the undertaking this season. Details of the work were given in an article, entitled, "The Greater Winnipeg Water Supply from Shoal Lake," published in our issue of December 2nd

"Genuine Economy in Home Building" is the title of an interesting, well-illustrated booklet received from the Hydraulic-Press Brick Company, St. Louis, Mo., makers and distributors of Hy-tex face brick. The illustrations are beautifully colored and bring out to great advantage the possibilities of the material

CONVENTION NEWS

The American Concrete Institute will convene at Chicago from February 9th to 12th. The Secretary is Mr. E. E. Krauss, of Philadelphia.

The Annual Convention of the British Columbia members of the Canadian Society of Civil Engineers was held at the Empress Hotel, Victoria, B.C., on December 12.

The Annual Meeting of the American Society of Engineering-Contractors will be held in New York City on January 15th. Mr. J. R. Wemlinger, of New York City, is the Secretary.

The Association of Government Contractors (U. S.) will hold their Annual Meeting at Washington, D.C., next month (January 4th to 7th). The Secretary is Mr. Algernon Blair, of Montgomery, Ala.

The Eleventh Annual Convention of the American Road Builders' Association is now being held at Chicago. The dates of the meetings are December 14-18. The President is Mr. W. A. McLean, Toronto, and the Secretary, Mr. E. L Powers, 150 Nassau Street, New York.

Mr. W. A. McLean, Toronto, President American Road Builders' Association, now in session at Chicago.

The Society of Constructors of Federal Buildings will hold their Annual Convention at Washington, D.C., next month (January 4th to 6th). The Secretary is Mr. T. R Maul, of Philadelphia, Pa.

The American Society of Heating and Ventilating Engineers hold their Annual Meeting in New York City next month (January 20th to 22nd). The Secretary is Mr. J. J Blackmore, of New York City.

The Annual Meeting of the Victoria Branch of the Canadian Society of Civil Engineers for the election of officers and the transaction of general business was held on December 9. The Secertary of the Branch is Mr. R. W. Macintyre.

As announced in our issue of December 2, the annual convention of the Canadian National Clay Products Association is to be held at the King Edward Hotel, Toronto, January 26-28 next. We now learn that Mr. Daniel A Lochrie, a well-known member of the Association, and proprietor of the Park Theatre, Toronto, has placed his theatre at the disposal of the Association for Tuesday evening, Janu [illegible] special films, illustrating building construction, will be shown. The following is a list of speakers, with the subjects of their addresses: Dr. A. C. McKay, President of Toronto Technical Schools, "Toronto Technical Schools and their Relation to the Manufacture of Clay Products"; Mr. W. W. Smith, Shallow Lake, Ont., "The Making and Burning of Clay Tile"; Mr. A. F. Greaves-Walker, Manager, Sun Brick Company, Toronto, "Kiln Kinks"; Mr. E. W. Knapp, "Possibility of Manufacturing High-Class Paving Bricks in Ontario"; Mr. Andrew Kruson, "Cheap Glazes for Use on Ontario Clays and Shales"; Mr. Philip W. Green, "Standardization of Clay Products from an Architect's Point of View."

The merging of national road conventions in an All-American Road Congress at San Francisco in 1915 during the exposition, was foreshadowed in a meeting of the Directors of the American Highway Association held in Washington recently. The Board authorized a committee of two members to meet a like committee from the American Road Builders' Association, these four to choose a fifth member and thus form an executive committee to handle the great road congress. The two associations named have in their own ranks or immediately identified with them practically all of the recognized official and unofficial good roads workers in the United States and Canada. At the Road Congress held recently in Atlanta, Georgia, by the American Highway Association and its allied organizations, upwards of four thousand delegates and visitors were registered. At the convention at present being held in Chicago under the auspices of the American Road Builders' Association, it is expected that the registration will not be far short of the Atlanta attendance. The combining of these two great meetings should result in an attendance of from 7,000 to 10,000.

Personal Mention

Mr. Jas. R. Valk has been appointed Western Sales Manager for the United States Asphalt Refining Company, New York. Mr. Valk's office will be in the Harris Trust Building, Chicago.

Mr. J. S. MacLachlan read a paper, entitled, "Victoria Breakwater Construction" (illustrated by lantern slides) before the Victoria Branch of the Canadian Society of Civil Engineers on December 11.

Mr. W. W. Pearse, City Architect, Toronto, will address the Canadian National Clay Products Association at the annual convention of that body which is to be held at the King Edward Hotel, Toronto, January 26-29, 1915.

Mr. J. S. McCannel, president of the Milton Pressed Brick Company, Milton, is scheduled to deliver a paper, "Steam Shovel for Handling Shale and Clay," at the convention of the Canadian National Clay Products Association, which is to be held at Toronto, January 26-29, 1915.

In connection with the appointment of Mr. Georges Janin as Major in the corps of engineers which he was largely instrumental in raising at Montreal, and having in mind the probability of his leaving the country on active service shortly, it is of interest to note that as chief engineer of the city of Montreal, at a salary of $9,000 per annum, Mr. Janin is the leading member of the municipal engineering profession in Canada. With this in mind, and seeing that Mr. Janin is 61 years of age, his example in offering his services to his country is particularly commendable.

Announcement is made of the death of Mr. W. J. Tregillus, of Calgary, well known in that city as the founder of the Tregillus Clay Products, Limited. The late Mr. Tregillus, who was a native of Plymouth, England, was active in civic and provincial circles. He was serving the city as an alderman and he was a Governor of the University of Calgary.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

The ratepayers of Hull, Que., will vote in January on a bylaw to raise $100,000 for water-works extensions.

At the January elections, the ratepayers of Brantford, Ont., will vote on a bylaw to raise $100,000 for the completion of the water-works plant.

The ratepayers of Guelph, Ont., will vote next month on a by-law to authorize the expenditure of $125,000 for an addition to the Collegiate Institute.

Foundation work has been completed for the new school building which is to be erected on Givens Street, Toronto, for the Board of Education at a cost of $165,000.

At Toronto, the Works Committee have approved of a street extension through Mount Pleasant. The work, which will cost $275,000, will include the construction of a bridge over the old Belt Line.

On the occasion of his recent visit to Toronto, Sir Robert Borden made a complete tour of the harbor work now under construction. He was accompanied by the Mayor and the members of the Harbor Commission.

For the Danforth section of the Bloor Street Viaduct, the Toronto City Council has accepted the tender of Messrs. Quinlan & Robertson, of Montreal, at $947,076, for steel construction, lower deck to be completed in future.

The ratepayers of Peterborough, Ont., will be asked to vote next January on a bylaw in favor of the Canadian General Electric Company, who propose to spend $150,000 on plant and equipment for the manufacture of railway cars.

Tenders close December 24 with Messrs. Burke, Horwood & White, Toronto, for the erection of the Masonic Temple which is to be built on Spadina Road at a cost of $300,000. Mr. H. B. Knowles, New York City, is the architect.

Messrs. Barnett & McQueen, Fort William, Ont., are the successful contractors for the new grain elevator which the Dominion Government is erecting at Vancouver at a cost of some $700,000. The building is to be of reinforced concrete and steel construction. Its capacity will be 1,250,000 bushels.

The Montreal Builders' Exchange have objected to the City Council's advancing the wages of the laborers from $2.25 to $2.50 a day, in view of the fact that the current rate for building laborers is $1.50 a day. It is suggested that instead of advancing wages the Council should find more employment.

At Toronto, the Board of Control have approved the recommendation of Mr. R. C. Harris, the Works Commissioner, that a road shall be opened through Mount Pleasant Cemetery at a cost of $275,000. Two small bridges—one a 112-ft. footbridge and the other a 180-ft. trestle—will be erected.

The new assembly hall which St. Patrick's Parish is erecting on Dorchester Street, Montreal, is nearing completion. The building is of stone and brick construction and has cost $135,000. The architect was Mr. J. P. Hynes, and the general contractors were Messrs. John Quinlan Company, both of Montreal.

From Sydney, N.S., comes the gratifying report that two thousand men are employed at the Dominion Steel Company's plant. This is more than two-thirds of the full force in the busiest times. Rod, bar, nail, wire and billet mills are working full time, double shift, and a ten thousand ton order of rails is being rolled. Four shipments of wire have been sent to England, and other shipments will follow as soon as possible.

At Montreal, work has started on the concrete subway under the C. P. R. tracks at Park Avenue. The engineer in charge is Mr. J. Emile Vanier, of Montreal, and the general contractors are Messrs. Laurin & Leitch, Montreal. The Dominion Bridge Company have the contract for the steel work. The estimated cost of the undertaking is $176,000.

The Toronto-Hamilton Highways Commission, of which Mr. George Gooderham, of Toronto, is Chairman, have under consideration draft plans for a high level bridge at Carroll's Point, Hamilton, Ont. The plans were prepared by the Hamilton Bridge Company and the estimated cost is $327,000. The proposed undertaking will be financed by the city of Hamilton and the County of Wentworth.

The new church which the Capuchin Fathers are erecting at Fairmount and Wellington Streets, Ottawa, at a cost of $156,000, is nearing completion, although work has not yet started on the interior. The architect is Mr. Chas. Brodeur, Hull, Que., and the general contractors are Messrs. Noel & Monette, 567 St. Patrick Street. The building is 67 x 241 ft. in dimensions, of brick construction.

WESTERN CANADA

Road improvements estimated to cost $100,000, have been authorized at Port Coquitlam, B.C., by the local council.

It is of interest to note that the ratepayers of West Vancouver have approved a bylaw to raise $150,000 for the installation of a water-works system.

The municipal council of Saanich, B.C., are advancing two schemes of road improvement—the Shelbourne and Lake Road extensions. The estimated cost of the proposed work is $80,000.

The Taylor Engineering Company, Limited, Vancouver, B.C., has been incorporated with a capital of $50,000. The new firm will manufacture mechanical and electrical machinery and appliances.

A noteworthy contract awarded recently by the Dominion Government was that for the new elevator at Vancouver. The successful contractors were Messrs. Barnett & McQueen, and the price was $500,000.

The value of Vancouver's building permits for the eleven months ending November 30 was $4,445,000. The permits last month, which amounted in value to $1,387,000, just trebled the figures for November last year.

Excavating has been completed for the new Great Northern Railway station at New Westminster, B.C. The actual construction of the building will be started as soon as the plans have been approved by the Railway Commissioners.

The services of Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation, have been placed at the disposal of the Civic Centre Committee of Vancouver in connection with the plans submitted in the recent competition.

At Prince Rupert a start is about to be made on the construction of a new court-house for the Provincial Government. At the time of writing no contract has been awarded, but excavating for the building is to be started shortly. The architect is Mr. A. A. Cox, of Vancouver.

The court-house at Swift Current, Sask., which has been erected at a cost of $105,000, is nearing completion. The building is two storeys high, 100 x 75 ft. in dimensions, of stone, brick and reinforced concrete construction. The general contractors are Messrs. P. J. Lecky Company, Limited, Regina.

The McLeod Block, which is being erected on the corner of Rice and McDougall Streets, Edmonton, at a cost of $600,000, is nearing completion. The building, which is of fireproof construction, is nine storeys high and fronts on McDougall 118 feet and on Rice 100 feet. The outside finish is in cream brick, and terra cotta, plain with half cornice in classic style over all. The contractors are Olsen & Jackson, and the architect John K. Dow.

The new provincial jail at Regina has been officially opened. The jail at present consists of the main cell block, 60 by 200 feet, and administrative building, 50 by 80 feet, with kitchen and chapel block about 40 feet square. The building is three storeys in height, and is built of brick, stone and reinforced concrete construction, it being fireproof throughout. The plans make provision for another block of similar dimensions, but it will not be built until required.

Up to November 20 the Greater Winnipeg Water District had expended $1,413,605, according to the statement contained in the report of the Commissioners. The canal being constructed by the Northern Construction Company, Limited, to improve the Brokenhead River, is completed, and the dredge has been taken out. The entrance to the south end will be improved by hand labor. The Northern Construction Company, Limited, will also construct a gravel pit spur on the orders of the commissioners.

Mr. David McGill, dealer in building supplies, has removed from 83 Bleury Street to 320 Lagauchetiere Street West, Montreal.

The following are now the sales engineers of the Canadian Sirocco Company, Limited, of Windsor, Ont.: A. M. Nichols, 301 McGill Building, Montreal; C. T. Morse, 43 Victoria Street, Toronto; W. P. Eddy, 301 Tribune Building, Winnipeg; S. S. Clarke, 605 2nd Street, Calgary, Alta.

The Merits of Creosoted Block Pavement

It will be interesting to readers of the Contract Record to learn that the Canada Creosoting Company, Limited, of Toronto and Trenton, Ont., have appointed The Creosoted Block Paving Company, Limited, 76 Adelaide Street West, Toronto, sole agents for the sale of creosoted wood paving blocks. This company have been formed only recently and are to be entrusted with the laying and guaranteeing of the block that is creosoted at Trenton. Messrs. W. G. Campbell and C. H. Lattimore, of the contracting firm of Campbell & Lattimore, together with Mr. J. L. Boyd, who is also well known in contracting circles, are directors of the new company, in whose hands we are sure the interests of the public will be closely supervised.

Modern wood pavements are increasing in popular favor more and more every day. Prior to 1900 the supply of wood block pavements on this continent was comparatively small. To-day they are to be found in all the principal cities of the world.

In connection with this pavement a few detailed particulars concerning the treatment of the blocks by way of preparation will not be out of place. Blocks are treated at the factory in cylinders filled with creosote oil and a pressure of approximately 150 lbs. per square inch is applied until the blocks have been filled with the required amount of oil. This prevents the decay of the wood and also renders the blocks impervious to moisture. The blocks are laid on concrete of such thickness that there is no chance of the weight of traffic breaking through. It is claimed for creosote wood paving that it is immune from wear, extremely durable, renders heavy traffic practically noiseless and has proved its superiority to paving of every kind from all viewpoints.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brantford, Ont.

A bylaw will be submitted to the ratepayers at the January election to authorize the raising of $100,000 to provide for the completion and extension of a water-works system now under construction for the city council. Mr. F. W. Frank is secretary-treasurer. Messrs. Chipman & Power, 204 Mail Building, Toronto, are the engineers.

Halifax, N.S.

Tenders will be received by Mr. E. H. Armstrong, Provincial Government Public Works Commissioner, until noon December 31, for the construction of 113 culverts in Annapolis County. Plans and specifications are at office of Mr. W. G. Parsons, Middleton; Mr. O. S. Miller, clerk, Bridgeton; Mr. I. J. Whitman, Torbrook; Mr. J. E. Shaffner, Annapolis, and at Department, Halifax.

Kamloops, B.C.

The municipal council (Light & Power Department), will borrow $35,000 for extension to water-works and $40,000 for extensions to electrical power plant. Mr. J. J. Carment is city clerk. Mr. C. North is Supt. of Department.

London, Ont.

The construction of tile sewers on the following streets is contemplated by the city council: William Street, from Cheapside to Victoria Street, $2,168.90; Colborne Street, from Horton to Bathurst Street, $737.73; Langrath Street, from Cathcart to Edward Street, $2,238. Mr. W. N. Ashplant is City Engineer.

London Township, Ont.

A by-law will be submitted to the ratepayers about January to authorize the construction of drains by the township council. Tenders will be called about February or March. Mr. F. W. Farncomb, Bank of Toronto Chambers, London, is the engineer.

Lindsay, Ont.

The town council is having plans prepared for the construction of a sanitary sewer and cellar drain on Regent Street, at an estimated cost of $4,940. 6-in. and 9-in. glazed pipe is to be used. Mr. A. J. Williams is town commissioner and engineer.

North Dorchester Township, Ont.

Work is to start immediately on the laying of drain for the township council at an estimated cost of $2,212. Messrs. Moore & Parry, Gladstone, Ont., are the general contractors. Mr. W. B. Lane, Dorchester Station, Ont., is the town clerk.

North Easthope Township, Ont.

The general contract for the construction of Krampian drain, embracing approximately 700 ft. of tile, has been awarded by the township council to Messrs. Crowley & McDonnell, Gadshill, at $2,494. Mr. J. D. Fisher, R. R. No. 1, Stratford, is the township clerk.

Ottawa, Ont.

The construction of a tile pipe sewer on Bank Street, between Cameron and Riverdale, is contemplated by the city council.

Tenders for 12-in. pipe will be invited next month in connection with the laying of water mains on Bank Street at an estimated outlay of $12,000, for the city council. Mr. R. L. Haycock is Water-works Engineer. This work will not be started until next spring.

The city council has started work on the laying of asphalt and stone block between Gladstone and Arlington Avenue. Surface drainage has been started by day labor. Tenders for balance of work will be called soon. The work is estimated to cost $12,000. Mr. F. C. Askwith is City Engineer.

Toronto, Ont.

Time has been extended until December 22 for the receipt of tenders to supply 567 ft. of 48-in. cast iron pipe and 400 ft. of 66 in. cast iron pipe. Plans are at office of Mr. Harris, Commissioner of Works.

Winnipeg, Man.

Plans are in progress for the following alterations to boiler plant for Municipal Hospitals as follows: installation of water supply, $885; forced draft apparatus, $610; shaker grates, $412; trap and receivers, $1,250. Pumps, valves, fan and accessories will also be required. Work may be carried out by day labor. Mr. W. P. Brereton, 223 James Avenue, is the engineer, the consulting engineers being Messrs. Roberts & Frith, Canada Building.

West Vancouver, B.C.

The ratepayers have approved of a bylaw for the carrying out of a waterworks system here at a cost of $150,000, work to start early next year. The scheme will include piping from Sister's Creek, where a dam, 26 ft. high, by 10 ft. long will be constructed. A large quantity of material will be purchased. Mr. H. McPherson is the engineer.

CONTRACTS AWARDED

Toronto, Ont.

Contracts as follows have been awarded by the Board of Control for the construction of sewers: Godson Contracting Company—East Lynne, $1,947, West Lynne, $2,730, Indian Road, $1,692, Maberly, $1,245; Grant Contracting Company—Annette Street, $350; Orpen Company, Limited—Brighton Place, $568; R. J. Moyes & Company—Copeland, $2,480; Routley & Summers—Merrill Avenue, $647; Toms Contracting Company—Merrill Bridge Road, $847; Jennings & Ross—West Toronto sewers, Sec. No. 2, $23,500.

Railroads, Bridges and Wharves

Broadview, Sask.

Grading and pile testing has started on $40,000 steel and concrete bridge over Elcapo Lake for the Provincial Government Board of Highway Commissioners. Parsons Construction & Engineering Company, Limited, Regina, have the general contract. Mr. F. J. Robinson, Parliament Bldgs., Regina, is chairman and engineer.

Ottawa, Ont.

The city council has directed that tenders be invited at once for the contarct to construct a Bascule bridge across Pretoria Avenue at an estimated cost of $120,000. The city engineer is Mr. F. C. Askwith.

Province of Quebec

The Canadian Pacific Railway Company is constructing a spur and a siding in this province. The Grand Trunk Railway is also constructing an extension to siding in Parish of St. Bruno, Chambly County.

St. Catharines, Ont.

Tenders are in for contract to erect bridge superstructure on St. Paul Street, steel construction, 1,236 feet long, 41 feet wide, 89 feet high. The following are the tenders with the amounts: Canadian Bridge Company, $91,420; Hamilton Bridge Works, $97,425; Dominion Bridge Company, $101,879; McGregor & McIntyre, $112,012; Canadian Allis-Chalmers Company, $122,448; Standard Steel Conc Company, $133,360. Mr. W. P. Near is city engineer.

Toronto, Ont.

The city council has awarded the contract for the construction of Bloor Street Viaduct (Don Section), to Messrs. Quinlan & Robertson, Montreal, at $947,076. The specification for steel has been adopted and the viaduct will have five steel arch spans, with piers and approaches, concrete foundations. Length 1,618 ft., width 86 ft.

Mr. R. C. Harris, Commissioner of Works, has recommended to the board of control that the tender of Messrs. Quinlan & Robertson, Montreal, for the steel construction of Bloor Street Viaduct (Don section) at $947,076 be accepted.

Plans are drawn by the board of control for a new bridge which it is proposed to construct on St. Clair Avenue E., to replace present Moore Park structure.

CONTRACTS AWARDED

London, Ont.

The contract for the supply of shifller poles at $3.33 plus 25c. a hundred loads for angle sections has been let by the London and Port Stanley Railway Company to the Canadian Bridge Company, Walkerville.

St. Catharines, Ont.

The city council has awarded the contract for a steel sub-structure to bridge on St. Paul Street, to the lowest tenderer, the Canadian Bridge Company, Walkerville, at $85,420. The bridge will be steel construction, 1,236 ft. long, 41 ft. wide, 89 ft. high. Mr. W. P. Near is City Engineer.

Public Buildings, Churches and Schools

Atwood, Ont.
The new $5,000 church building for the Methodist Church Congregation here will be white brick construction. The architect has not yet been appointed. Messrs. S. Love and W. Hance are members of the Building Committee.

Athabasca, Alta.
The Forest School District, No. 3171, has been authorized to raise funds for building and equipping a school here. Mr. E. D. Johnston, Athabasca, is treasurer of the School Board.

Birchcliffe, Ont.
Residents here have made a request for the formation of a new school district. Mr. Thos. Crawford, Agincourt, Ont., is the clerk.

Battenburg, Alta.
The Heathfield School District, No. 3154 (Mr. A. McIntyre, Battenburg, treasurer) will raise $1,000 for a school, fence, and well.

Berthier, Que.
Tenders have been received and the contract will be awarded next spring for the contract to erect a $7,000 dormitory for the Provincial Government Department of Public Works. Messrs. MacDuff & Lemieux, 104 Union Avenue, Montreal, are the architects.

Craig Murray, Alta.
The Craig Murray School District has just been formed and a school building will be erected shortly. Mr. A. E. Brown, Craig Murray, is a trustee.

Edmonton, Alta.
The sub-contract for plumbing, heating, painting and electrical work has not yet been let [illegible] $40,000 school building for the Separate School Board. The building is two-storey, 74 x 84, brick and steel construction. Messrs. [illegible] Bros. & Clendinning, 51 McAuley Street, are the general contractors. Mr. A. J. McCormack, 16 Bradburn Thomas Block, is the architect.

All interior fittings except desks will be supplied by the general contractors. Messrs. Read, McDonald & Brewster, Tegler Block, in connection with $150,000 school building, two-storey, 115 x 164 ft., for the Public School Board. Mr. Turner, Mortlake Block, is the architect.

The Merchants Bank of Canada will erect a [illegible] bank building [illegible] on [illegible] Streets. Messrs. Barnes & Gibbs, Imperial Bank Building, are the architects. The general contract has not yet been let.

Entwistle, Alta.
The Evanston School District, No 2902, has obtained authority to raise funds for the erection of a small school and equipment here. Mr. A. W. Arnup, Entwistle, is treasurer.

Elstow, Sask.
The Athens School District, No. 1533, has decided to borrow $5,000 to erect a two-room school and purchase equipment. Building will be brick veneer construction. Mr. H. J. Binnie, Elstow, is secretary-treasurer.

Foremost, Alta.
The Morgan School District, No. 3199, (Mr. A. D. Medhurst, Foremost, trustee) has been organized and a school building will be erected.

Gleichen, Alta.
The erection of a school building here is contemplated by the East Arrowood School District No. 3201. Mr. G. A. Shambetger, Gleichen, is one of the trustees.

Jasper, Alta.
The Jasper School District No. 3063 has been authorized to raise funds to erect a school building here. Lillian Taylor, Jasper, is secretary-treasurer.

Kingston, Ont.
All material is being furnished and all work done by the general contractor, Mr. C. H. Wright, Wolfville, in connection with the construction of a church building, estimated to cost $7,500, for the Methodist Church of Kingston.

Kuper Island, B.C.
The Dominion Government Department of Indian Affairs will purchase school furniture and industrial equipment in June, 1915, for Indian school, in course of construction at a cost of $60,000. The main building is three storeys, two wings, two storeys; also chapel and laundry. Concrete construction. The Island Building and Construction Company, Duncan, B.C., have the general contract.

Le Pas, Man.
The trustees of Le Pas School District, No. 1635, require plans which will be received until February 1, for 8-room brick school house, estimated to cost from $40,000 to $50,000. Mr. David Clapp, Le Pas, is the secretary-treasurer.

Lundbreck, Alta.
A school building will be erected and equipment purchased by Willow Valley School District, No. 3200. Mr. W. J. Riley, Lundhurst, is a trustee.

Maisonneuve, Que.
The Maisonneuve Methodist Church will purchase interior fittings for church building, 60 x 72, brick construction. Messrs. Anglins, Limited, Montreal, are the general contractors. Messrs. Peden & McLaren, 20 St. Alexis Street, Montreal, are the architects.

Medicine Hat, Alta.
Interior fittings will be purchased by the Dominion Government at Ottawa for $40,000 addition to post office and customs house here. Mr. M. C. Sackrider, is the general contractor. Mr. John Trimble, Bell Block, is the architect. Mr. R. C. Desrochers is secretary, Dominion Government Dept. of Public Works.

Metiskow, Alta.
The Metiskow School District, No. 3027, has been authorized to raise $1,200 for the construction of a small school and the supply of equipment. Mr. M. W. Skinner, Metiskow, is treasurer.

Montreal, Que.
A permit to carry out alterations to store on St. Denis Street has been issued to Mr. Omer Mayer, 1146 St. Denis Street.

A permit to erect five flats, three-storey, 32 x 45, at an estimated cost of $3,800, has been taken out by Mr. N. Hamelin, 1808 Henri Julien Street.

Alexandria Hospital Board, Charron Street, will purchase interior fittings for Nurses' Home, the construction of which is almost completed. Messrs. T. Pringle & Son, Coristine Building, are the architects. Messrs. A. F. Byers & Company, 240 University Street, Montreal, are the general contractors.

Mosside, Alta.
The Summerside School District, No. 3131 (treasurer, Mr. Chas. Sutherland, Mosside) will borrow funds for the erection of a small school building and the supply of equipment.

New Westminster, B.C.
Prices on sand, gravel, cement and lumber are invited by the Dominion Construction Company, Northwest Trust Building, Vancouver (general contractors), for alterations and addition to court house building, three-storey and basement, 98 x 45, brick construction,, stone trim, estimated to cost $56,000, for the Provincial Government Department of Public Works. Mr. J. E. Griffith, Victoria, is engineer. Messrs. Gardiner & Mercer are the architects.

Notre Dame de Grace, Que.
The sub-contract for tile and ornamental iron work and roofing will be let in a few days by the general contractor, Anglins, Limited, 65 Victoria Street, Montreal, in connection with $400,000 college on Sherbrooke Street, for Loyola College, 68 Drummond Street. Owners will purchase interior fittings. Gynasium equipment will not be required at present. Building will be stone and fireproof construction. Messrs. Peden & McLaren, 20 St. Alexis Street, Montreal, are the architects.

Ottawa, Ont.
Tenders are open for piling work on $30,000 club house for Ottawa Canoe Club, Rockliffe. Piles are to be 35-ft. hemlock. Prices to be per driven foot. Tenders are in for balance of work, but no contract has yet been awarded. Messrs. Meredith, Findlay & H. Wheelgrove, 126 Sparks Street, are the architects.

Quebec, Que.
The Parish of Domaine Lairet are contemplating the erection of a Presbytery here. The architect has not yet been appointed.

Sackville, N.B.
A military building, to be used for the instruction of students of Mount Allison University, is to be erected here by the Dominion Government Department of Militia & Defence, at an estimated cost of $12,000. Col. E. Fiset, Ottawa, is Deputy Minister.

Spruce Bluff, Sask.
The Waskiogon School District, No. 3457 has just been formed and a school building will be erected later. Mr. [illegible] Clark, Spruce Bluff, is the treasurer.

St. Pierre Claver, Que.
Plans and specification are at the office of the architects, Messrs. Venne & Leabelle, 5 Beaver Hall Square, who will receive tenders until 5 p.m., December 28, for the erection of a church and parsonage for the parish.

Standard, Alta.
Funds will be raised by the [illegible]

School District No. 2505, for an addition to school building here. Mr. H. W. Larsen, Standard, is the treasurer.

St. Agathe de Monts, Que.
The Dominion Government Department Public Works will call for tenders for interior fittings shortly, in connection with the new post office building in course of construction at an estimated cost of $34,200. Mr. J. C. R. Grou, St. Lambert, Que., is the general contractor. Messrs. Finley & Gagnon, New Birks Building, Montreal, are the architects.

Swift Current, Sask.
Work has been stopped for the winter on two-storey court house building for the Provincial Government Department of Public Works. The building, when completed, will involve an outlay of about $103,000.

Toronto, Ont.
The Board of Control is including in next year's estimates the sum of $5,000 for the erection of a Club House in Carleton Park. Mr. C. E. Chambers is Parks Commissioner.

The Public Library Board has in contemplation the erection shortly of a new library building to replace the present structure on Queen Street East. Site for new building has not yet been selected. Mr. E. S. Caswell, College and St. George Streets, is secretary-treasurer.

Victoria, B.C.
Tenders will be received by Mr. J. E. Griffith, Minister of Public Works, Provincial Government Department, until December 29th for the delivery and setting up of furniture for the library, Parliament Buildings. Plans and specification in connection with the work are at the office of the Government agent, Vancouver, and also at the Department of Public Works, Victoria.

Walkerville, Ont.
The Building Committee of Lincoln Road Methodist Church will purchase seating about the middle of January for $40,000 church building on Lincoln Road, two-storey, 72 x 72 ft. Mr. W. Wollatt is chairman of the Building Committee.

Willmar, Sask.
Wilmar School District, No. 3476 (Mr. Thos. Larkin, Willard, treasurer), was organized recently and a school building will be erected in the near future.

CONTRACTS AWARDED

Chatham, Ont.
The following contracts have been awarded for $5,000 alterations to bank building for the Merchants Bank of Canada: general contract, Mr. Wm. Robertson; carpentry, Mr. Harry Rayment; painting, Mr. W. H. Palmer; plumbing, Messrs. Mitchell Bros. Alterations will include marble floors and fixtures. Messrs. Hogle & Davis, 80 St. Francis Xavier Street, Montreal, are the architects. Supervising architects, Messrs. Adams & Adams, 49½ King Street West, Chatham.

Guelph, Ont.
The general contract for alterations to interior of Priory Club has been awarded to Mr. P. H. Secord. Mr. Robert Stewart is chairman of the Club.

Toronto, Ont.
The contract for terrazzo floors in 12-room school building, estimated to cost $55,000, for the Board of Education, has been awarded to the Italian Mosaic & Marble Company at $672.

The Italian Mosiac & Marble Company have been given the contract for terrazzo floors in connection with $32,000 addition to Roden Street School, at $848.

The contract for heat regulating of $60,000 school building on Leslie Street, has been awarded to the Johnson Temperature Regulating Company of Canada, Limited.

Business Buildings and Industrial Plants

Brantford, Ont.
Tenders for several trades in connection with $7,000 furniture store in course of construction for Messrs. Reid & Brown, 151 Colborne Street, have yet to be let. Buildings will be two storeys, 32 x 100 ft., pressed brick front and sand-lime brick construction. Ingleby-Taylor Company, Limited, Brantford, are the general contractors. Mr. A. J. Croman is the architect.

Calgary, Alta.
Plans have been prepared by Messrs. Holman & Gotch (architects), Dominion Bank Building, for the construction of a residence for Mr. G. A. Blackman, at an estimated cost of $3,500. Work will be commenced next spring.

Cornwall, Ont.
The contract to install electric fittings in new addition to Hotel "Dieu" for the Sisters of St. Joseph, has been let to Messrs. Parker & Masterson, Cornwall. Elevator will not be installed at present. Building is three storeys and basement, 112 x 80, cut stone, reinforced concrete, terra-cotta, steel, fireproof and brick construction. Mr. C. P. Meredith, 126 Sparks Street, Ottawa, is the architect.

Daysland, Alta.
An elevator belonging to the Berrard Grain Company has been destroyed by fire. The loss to the building amounted to $7,500, insurance on building and grain $25,000.

Edmonton, Alta.
The Lyceum Theatre, also a store, the property of the Northern Hardware Company, have been burned down. The loss is estimated over $30,000.

Fenelon Falls, Ont.
The following stores on Main Street have been destroyed by fire: Implement business, owner Mr. W. T. Robson; hardware, owner Mr. F. C. Taylor; carriage shop, owner Mr. F. C. Chambers; harness shop, owner Mr. J. Foster.

Greenfield, Ont.
A barn and stables, the property of Mr. Robert Cairns, 4th Con. West Flamboro, Greaisville P.O., has been destroyed by fire. Loss $4,000, insurance $1,700. Owner will rebuild.

Hagersville, Ont.
The Asbestos Manufacturing Company, Limited, Lachine, has been awarded the sub-contract for roofing $14,000 drill hall for the Dominion Government Department of Militia and Defence. The contract for interior fittings has not yet been let. W. A. Tom Construction Company, Collingwood, has the general contract.

Montreal, Que.
The permit to erect a billiard hall, two-storey, 100 x 64 ft., has been issued to Mr. E. Piche, 2557 Waverley.

The Canadian Rubber Company, Notre Dame Street, E., have obtained a permit to construct alterations to storage warehouse, estimated to cost $2,000.

Sub-trades will be let as required in connection with the construction of stables on Western Avenue at an estimated cost of $20,000 for Mr. Armand Malo, 100 St. Jerome Sstreet. Mason work will be done by day labor, and steel work by Phoenix Bridge & Iron Works, Limited. Mr. Sydney Comber, 1215 Green Avenue, is the architect.

Plans are drawn for one-storey 63 x 14 ft. cattle shed at Iberville, estimated to cost $4,000, for the Canadian Pacific Railway, Windsor Street Station.

New Westminster, B.C.
A site has been secured by the Mackie Mill & Mercantile Company, Gettysburg, Wash., for the erection of a shingle mill having a capacity of 200,000 shingles per day. Construction of the plant is to start shortly.

Oakville, Ont.
A by-law to raise $10,000 for the erection of a new building to contain fire hall and municipal offices, has been carried. Mr. W. E. Crawley is the town clerk.

Ottawa, Ont.
The LeTemps Printing Company, Dalhousie Street, contemplate leasing new $25,000 building on George Street from Syndicate S'Denvres Socales. The building, foundations for which are going in, will be five storeys, brick construction. Some machinery will be purchased by the company.

Tenders for plastering, heating, painting, plumbing and electrical work are being received in connection with the construction of a $4,500 residence on Melrose Avenue, for Mr. Wm. Cole, Hope Chambers, Sparks Street, Ottawa, owner and general contractor. Residence will be brick veneer, concrete foundation, shingle roofing.

Tenders will be called shortly for plastering, painting, heating, plumbing and electrical work, on $4,500 residence for Mr. W. R. Clark, 130 Sherbrook St.

Tenders for plastering, painting, heating, plumbing and electrical work will be invited shortly by Mr. H. Richardson, 25 Foster Street, owner and general contractor, in connection with $4,000 residence on Bethany Street, brick veneer construction, concrete foundation, shingle roofing.

Mr. B. A. Grison, 100 Fentiman Street, is at present receiving tenders for plastering, painting, heating, plumbing and electrical work on $5,500 residence on Riverdale Street.

A lumber mill on St. Catherine Street, owned by Messrs. Barrett Bros., destroyed by fire recently, will be rebuilt at an estimated cost of $10,000.

Stores and residences on Nicholas Street, destroyed by fire recently, will be rebuilt by Mr. M. O'Leary. Estimated cost $7,000.

A loss of $4,000 has been sustained in the destruction by fire of a store on Dalhousie, the property of Mr. J. B. Seneeal, Dalhousie & Rideau Streets.

Port Hope, Ont.
Round house, engine, tools, etc., the

property of the Grand Trunk Railway have been destroyed in a fire which occurred here recently.

Quebec, Que.
The structural addition to theatre is contemplated by the Quebec Olympia Company, 229 St. John Street. Mr. J. H. Paquet, 286 Grande Allee, is the president.

Revelstoke, B.C.
A bylaw will be submitted to the ratepayers this month to raise $10,500 for the purchase of a site on which to construct a market building for the city council. Mr. R. A. Gordon is city clerk.

St. Catharines, Ont.
Port Weller Security Company, 415½ Yonge Street, Toronto, is rebuilding barns recently destroyed by fire. Estimated cost $5,000.

St. Lambert, Que.
Plans are in progress and tenders will be called in a few days for the construction of pump house, concrete foundation, brick construction, for Greenfield Park School Commissioners. Machinery for the building has already been purchased. Messrs. Hutchison, Wood & Miller, Royal Insurance Building, Montreal, are the architects.

St. Thomas, Ont.
A loss of $20,000 was sustained to building and stock in a fire at the store of Messrs. W. E. Maxwell & Company, Talbot Street.

Toronto, Ont.
Plans are prepared by Mr. P. H. Finney, 79 Adelaide Street E. (architect), for the construction of four stores and apartments on Gerrard & Kingsmount, at an estimated outlay of $12,000. The buildings will be two-storey and basement, brick construction.

Westmount, Que.
The contract to build a garage for Mr. J. C. Hanna, Montrose and Mountain Streets, at a cost of $1,050, has been awarded to Mr. John Allan. Mr. R. G. [illegible] Building, Beaver Hall Hill, Montreal, is the architect.

Welland, Ont.
The contract for [illegible], for the Empire Cotton Mills, [illegible] has been awarded to Messrs. Ryan & Gardiner. The building will be one-storey, 50 x 100 ft., brick construction, concrete foundation.

CONTRACTS AWARDED

New Westminster, B.C.
The contract for a grain warehouse [illegible] has been awarded to Robinson Bros., New Westminster. The architects are Messrs. [illegible].

Ottawa, Ont.
The contract for alterations to stores, [illegible] construction, for Le Droit Printing Company, Rideau Street, has been awarded to Mr. A. [illegible], Ottawa, Ont.

St. Catharines, Ont.
The sub-contract for heating $26,000 telephone building, three storeys and basement, for the Bell Telephone Company of Canada, Adelaide Street W., Toronto, has been awarded to A. [illegible] & Son, St. Catharines. F. H. [illegible] & Sons, Brantford, are the general contractors. Mr. W. J. Carmichael, Montreal, is the architect.

Residences

Hull, Que.
A permit to erect a two-storey, 24 x 36, brick residence, has been taken out by Demasse Viau, 312 Champlain Avenue.

Montreal, Que.
A permit for alterations to flat, 3-storey, 15 x 32, has been issued to Mr. F. Chagnon, 320 Lafontaine Park.

A permit to build nine flats on St. Denis Street, three-storey, 50 x 52 ft., has been obtained by Mr. Ed. Sabourin, 1813 Clarke Street.

Anglins, Lmited, 65 Victoria Street, owners and general contractors, are purchasing material and doing all work on the construction of eight flats on Old Orchard Avenue, estimated to cost $32,000.

A permit to build three flats on Cartier Street, two-storey, 25 x 45 ft., has been taken out by Mr. C. H. Vermette, 2697 St. Lawrence Street.

Ottawa, Ont.
Tenders are open for plastering, painting, heating, plumbing and electrical work on $4,500 residence on Bristol Avenue, for Mr. B. A. Grison, 100 Fentiman Street.

Tenders on plastering, painting, heating, plumbing and electrical work will be called later in connection with a new residence on Gladstone Avenue, for Mr. W. J. Scobie, 201 Gladstone Avenue.

Plans are in progress for two residences on Nelson Street, estimated to cost $6,500 for Mr. Donald Fraser, O'Connor Street. Building work will not be started until next spring.

Tenders are now being received for plastering, painting, heating, plumbing and electrical work on $8,000 double residence on Somerset Street, brick construction, for Mr. Donald Fraser, O'Connor Street.

In connection with the construction of a $5,000 residence on Bellwood Avenue for Mr. B. A. Grison, 100 Fentiman Avenue, tenders are open for plastering, painting, heating and plumbing, and will be received by the owner. The building will be concrete block construction.

[illegible] tenders are [illegible] for plastering, painting, heating and electrical work on $12,000 frame and brick residence on Armstrong Street, for Mr. J. W. Foster, 11Irving Street, and Mr. E. Marks, 30 Spadina Avenue.

The construction of a residence on Irving Avenue at an estimated cost of $4,-[illegible] foundation, shingle roofing, is contemplated by Mr. W. C. Leach, 140 Spadina Avenue, owner and architect.

Mr. Jas. Allan, 175 Broad Street, is contemplating the construction of a $4,-[illegible] veneer construction, stone foundation.

St. Hilaire, Que.
Site for residence here has been purchased by Mr. N. K. Laflame, 230 Blvd. Street, Joseph West, Montreal. Owner will build next spring.

Toronto, Ont.
Plans are being prepared and tenders will be called shortly by the architect, Mr. W. A. Mahoney, Telephone Building, Guelph, for the contract to erect a $12,000 residence in Rosedale district, for Mr. A. Grauck, Bank of Toronto, Berlin, Ont.

Maisonneuve, Que.
Plans have been prepared and tenders will be caleld shortly by the architect, Mr. Marius Dufresne, Ontario and LaSalle Streets, for heating of $150,000 public bath for the city council. The contract for the granite work has been let to Mr. G. J. Picher, Montreal, at $8,900.

Power Plants, Electricity and Telephones

Birchcliffe, Ont.
Scarboro Township Council has decided to request the Provincial Hydro-electric Commission to supply a report on the cost of installing a hydro-electric plant and power for the lighting of Birchcliffe and Kalmar Heights. Mr. J. H. Matthews is the clerk.

Delaware, Ont.
The ratepayers of this village will vote on January 4 on a by-law providing for the installation of hydro-electric power in the village. Mr. J. H. Matthews is village clerk.

Edmonton, Alta.
The Dunvegan and B. C. Railway, c/o Engineer W. Smith, St. Albert Trail, are doing all work on $8,000 power house here, brick construction, concrete foundation, felt and gravel roofing.

London, Ont.
Tenders for electric supplies for 1915 will be invited at once by the city council (Board of Utilities Commissioners). Mr. H. J. Glaubitz, City Hall, is general manager and engineer.

North Vancouver, B.C.
A report dealing with an ornamental street lighting scheme from Ferry Wharf to First Street, has been submitted by Mr. A. M. West, municipal engineer, to the municipal council. If the project is approved, single standard, 300-watt, nitrogen-filled lamps will be used.

Province of Ontario
The steel contract in connection with the erection of a hydro transformer near [illegible], at a cost of [illegible], for the Provincial Hydro-Electric Commission, will be let at once by the general contractors, Messrs. John Hayman & Son, 432 Welington Street, London, Ont. A station 60 x 60 x 30 ft. high, of steel, reinforced concrete and red pressed brick construction, gravel roofing, wil be erected [illegible] thirty miles from [illegible].

Thornhill, Ont.
The ratepayers of this township are discussing the question of introducing a hydro street lighting scheme for Thornhill.

Wentworth County, Ont.
The Bell Telephone Company has in contemplation the installation of a new [illegible] of telephone lines extending from [illegible] to Capetown, a distance of [illegible] miles, and from Capetown to Lynden, a distance of four miles. The district manager is [illegible] Main Street East, Hamilton.

(Continued on page [illegible])

Tenders and For Sale Department

Tenders for Laying and Jointing of Water Pipes, etc.

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on **Tuesday, December 22, 1914**, for the Excavating, Laying and Jointing of Water Pipes, Valves, Hydrants and Special Castings, for the year 1915.

Specifications and tender forms for the foregoing may be obtained upon application at the office of the Water Main Extension Section, Department of Works, Room No. 9, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering, as prescribed by city by-law, must be strictly complied with, or the tenders may be declared informal. Tenderers shall submit with their tenders the name of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN (Mayor),
Chairman Board of Control.
City Hall, Toronto, Dec. 8, 1914. 50

TENDERS for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on

Tuesday, December 22, 1914

For the supply of

1. Iron Castings of Manholes, Gullies, Grates, Etc.
2. Treated Wood Blocks.
3. Sand.

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, December [illegible], 1914 50

To Manufacturers of Building Materials

Advertiser desires agency for Nova Scotia and Maritime Provinces, for manufacturers of Building Materials and Contractors' Equipment. At present representing one of the largest company's in Canada, and wishes to add other good lines. Address, Box 117, Contract Record, Toronto. 50

Tenders for Crushed Stone and Screenings

Sealed tenders, addressed to John Allan, Esq., Mayor, Chairman Board of Control, City Hall, Hamilton, Ontario, will be received by the undersigned up to 5 o'clock p.m. on **Monday, December 21, 1914**, for supplying the Corporation of the City of Hamilton with crushed stone and screenings for periods of one, five and ten years, according to specifications and form of tender to be had at the office of the City Engineer, City Hall, Hamilton, Ontario.

A marked cheque for $500 must accompany each tender, which cheque will be forfeited should the party whose tender is accepted fail to execute the necessary contract.

S. H. KENT,
City Clerk.
49-50

Miscellaneous

Galt, Ont.

A by-law will be submitted on January 15th by the town council to authorize the installing of a fire alarm system in the town. If the by-law passes, contract for work will be awarded forthwith. Mr. Joseph McCartney is the town clerk.

Kagawong, Ont.

Tenders will be received until 4 p.m. January 4th by Mr. R. C. Desrochers, Secretary Dominion Government Department of Public Works, for the supply of lumber and stone delivered at Kagawong. Lumber to consist of spruce, hemlock, white oak, white pine, B. C. fir. The stone is to include fine crushed rock. Specification, etc., are at office of District Engineer, Confederation Life Bldg., Toronto; Postmaster of Kagawong, and MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Montreal, Que.

Messrs. Dartnell, Limited, Montreal, have secured the following contracts for "Heinicke" Radial Brick Chimneys:—St. Lawrence Sugar Refineries, Limited, 185 ft. x 9 ft., Mr. John J. York, chief engineer; Loyola College, 75 ft. x 5 ft., Anglins, Limited, contractors, Peden & McLaren, architects; Toilet Laundry Company, Limited, 125 ft. x 6 ft., Hutchison, Wood & Miller, architects.

Welland, Ont.

A by-law to authorize the raising of $5,000 to provide a fire alarm system will be submitted to the ratepayers next January. The town has a population of about 5,000. Mr. Clarence W. Webber is town clerk.

Winnipeg, Man.

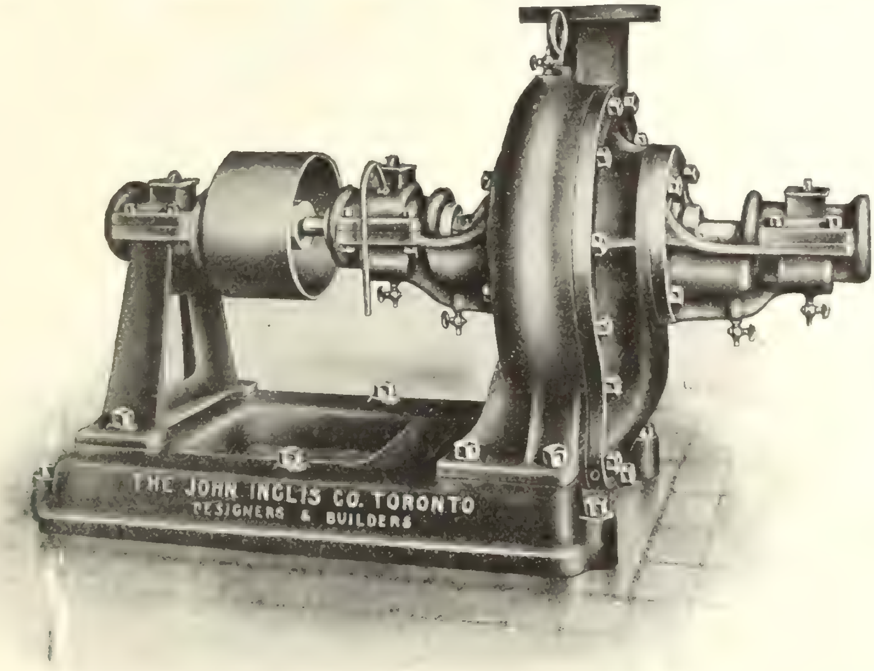
The Board of Control will receive tenders until December 21 for belt-driven vertical wheel press, 150 tons capacity, equipped with a two or three-plunger belt-driven pump. Specification, etc., are at office of City Engineer, Mr. W. P. Brereton, 223 James Street.

The determination of the use of reinforcement in concrete pavement will depend upon the type of foundation and width of pavement. Reinforcement may be used in either single or two-course work, and is particularly designed to care for slight settlement of fills, and to guard against contraction cracks developing where the pavement is wide. In any road where a new fill of over two feet is made, and the material used is other than sand or gravel, the pavement should be reinforced, no matter what the width of the road. No amount of compacting by roller or puddling can effectively settle such a fill, so that no further movement of the foundation is probable after the placing of the pavement. The type of reinforcement which is most economical in price and handling is wire fabric. The weight of material to use in this fabric has been the subject of much discussion and, although it may be well sometimes to consider each specific case, in general it may be said that reinforcing metal running parallel to the centre line of the pavement should have a cross-sectional area of 0.038 inches per foot of pavement width, and a cross-sectional area perpendicular to the centre line of the pavement of at least 0.049 inches per foot of pavement length.

The use of lime as a binding material for mortar originated in the remote past. It is probable that some savages when using limestone rocks to confine their fire noticed that the stones were changed by the action of the heat, says a report of the U. S. Geological Survey. A passing shower may have slaked the lime to a paste, and they discovered that the paste was smooth and sticky and was a better material than clay to fill the crevices in their crude dwellings. From this discovery it was but a step to add sand to the paste in order to produce a mortar.

For sanding slippery asphalt pavements and for sanding bleeding woodblock pavements a machine has been recently put on the market by the Kindling Machinery Company, Milwaukee, Wis. The device consists of an ordinary wagon, hopper-bottomed, the hopper feeding into a fan or spiral bladed sheet-steel disk, which revolves in a horizontal plane a few inches above the pavement. The disk is turned by bevel gears, the driving gear being mounted on a countershaft, which in turn is driven by a chain from the axle of the wagon. The sand is thrown, varying with the speed, a distance of from 20 to 60 ft. A lever operated by the driver controls the feed of the sand. The apparatus is claimed to spread 50,000 sq. yd. per hr. The material may vary from fine sand to 1¼-in. stone, so that the apparatus may be used in road-construction work.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

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ENGINEERS AND BOILERMAKERS

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Montreal Office: Room 509 Canadian Express Building

Late News Items

Leamington, Ont.

The following contract has been awarded by the town council to the Webster Construction Company, London, Ont., at $24,999, 6,500 ft. of open drain, 3,371 ft. of 48-in. 1,456 ft. of 36-in., [illegible] ft. of 30-in. reinforced concrete pipe, 2,956 ft. of 20-in. and 200 ft. of smaller vitrified tile; also construction of concrete highway bridge. Work is to start at once.

London, Ont.

The Board of Control will receive tenders until 9 a.m., December 18, for the laying of 690 ft. of 8-in. pipe with two brick manholes, and 858 ft. of 6-in. pipe, private drain connections. Mr. H. A. Brazier is the Engineer. Plans and specification are at office of engineer.

Maisonneuve, Que.

"Letourneau College," belonging to the Christian Brothers, 44 Cote Street, has been burned down, involving a loss estimated at $120,000.

Montreal, Que.

A loss of $30,000 has been caused through the destruction by fire of clothing warehouse on St. Lawrence Street, owned by the H. B. B. Cloak & Suit Company, 1272 St. Lawrence Street.

Ottawa, Ont.

Tenders will be received by Mr. R. C. Desrochers, Secretary, Dominion Government Department of Public Works, Ottawa, until 4 p.m., January 5th, for renewal of boiler on Dredge P. W. D., No. 3, "Restigouche." Plans and specification are at offices of Mr. A. Kastella, Mechanical Superintendent, Birks Building, Ottawa; Mr. J. K. Blenkensop, Superintendent of Dredges, St. John, N.B.; Mr. C. E. W. Dodwell, District Engineer, Halifax, N.S.; and Mr. J. T. Nicherson, Inspector of Dredges, Liverpool, N.S.

Province of Ontario

Contracts as follows have been let for the construction of a steel and concrete bridge over the Thames River, between the counties of Middlesex and Elgin: general contract, Mr. D. Witherspoon, Ailso Craig P. O., $20,900; steel, Sarnia Bridge Company. Bridge will be one span, 220 ft. long, 225 ft. approach, concrete abutments, piers and pedestals. Work will be started next spring. Mr. Chas. Talbot, C.E., London, is engineer for the Municipality of Middlesex. Mr. Jas. A. Bell, C.E., St. Thomas, is engineer for the Elgin Municipality.

Revelstoke, B.C.

A bylaw to raise $12,500 for sidewalk construction has been passed by the ratepayers. Mr. R. A. Gordon is city clerk.

Stratford, Ont.

The city council has plans in progress for the construction of a main sewer through the town.

A bylaw has been passed to raise $20,000 for sewerage extensions, to include the covering of a portion of Erie Creek. Mr. A. C. Manson, City Hall, is the engineer.

The city council is contemplating the laying of Tarvia pavement on a 5-in. concrete base, with concrete curbs and gutters. Estimated cost $14,550. Mr. Jas. A. Gray is chairman, Board of Works.

St. Ours, Que.

Tenders will be received by Mr. R. C. Desrochers, Secretary, Dominion Government Department of Public Works, Ottawa, until 4 p.m., January 4th, for the construction of Post Office Building, one storey and basement, concrete footings, waterproofed, steel, cut-stone and brick construction. Plans and specification are at office of Mr. R. R. Deschamps, Overseer, Dominion Building, Montreal; Post Office, St. Ours, and at Department, Ottawa.

Sarnia, Ont.

The city's municipal building has been destroyed by fire, with a loss estimated at $15,000. A new building will be erected. Mr. J. D. Stewart is city clerk.

Toronto, Ont.

Catalogues, Price Lists and samples of all building supplies and materials are wanted by Mr. H. S. Kaplan, Architect, 75 Macdonnell Avenue.

The general contract for the construction of sewers on Pape and Randolph Avenues has been awarded by the York Township Council to Messrs. Routly & Summers. Mr. Frank Barber, 57 Adelaide Street East, is engineer.

The Property Committee, Department of Education, has decided to call tenders for plastering upper floor of school building on Williamson Road. Estimated cost $2,000. Mr. W. C. Wilkinson is Secretary-Treasurer, Board of Education.

Tenders close December 22nd for the supply of iron castings of manholes, gullies, grates, etc. Plans, etc., are at Room 12, City Hall.

Tenders close December 22nd, with the Board of Control for the supplying of approximately 25,000 sq. yds. of treated wood blocks, and also a quantity of sand. Specification, etc., are at Purchasing Department, Room 12, City Hall.

Canadian Cartridge Company, Limited, has been incorporated with a capital stock of $100,000 and head office at Toronto, for the purpose of manufacturing brass, bronze, iron, steel, manganese and other metals; trading in copper, bronze, brass and steel products, hardware, cartridges, shells, rifles, ammunition, etc. The provisional directors, all of Toronto, are William Symon Morlock, Bruce Victor McCrimmon and Roy Beverley Whitehead.

West Hill, Ont.

A site has been purchased by the West Hill Rink Company, for a new covered rink. The building will contain offices for Municipal and Police Officers.

The strength and design of washers with reference to their bearing on wood have been investigated by L. R. Rodenhiser at Cornell University. The object of the investigation was to determine the safe bearing values and ultimate strengths of different woods under different washers and the economic sizes and weights of washers. The three main conclusions were: (1) For bolts of less than ½ in. in diameter no reinforcement of the washer is necessary, a flat plate large enough to provide sufficient bearing area being all that is required; (2) for each inch of diameter of the plate there should be a height of 3-16 in. for the spool, but no spool should be less than ¼ in. in height; (3) for each inch of diameter of the plate there should be a thickness of 1-16 in. for the spool, but no spool should be less than 3-16 in. in thickness.

IRON Fences, Wire Fences, Gates, Fire Escapes, Jail Cells, Office Wirework. Wire Baskets and all kinds of Builders' Wire and Iron-work.

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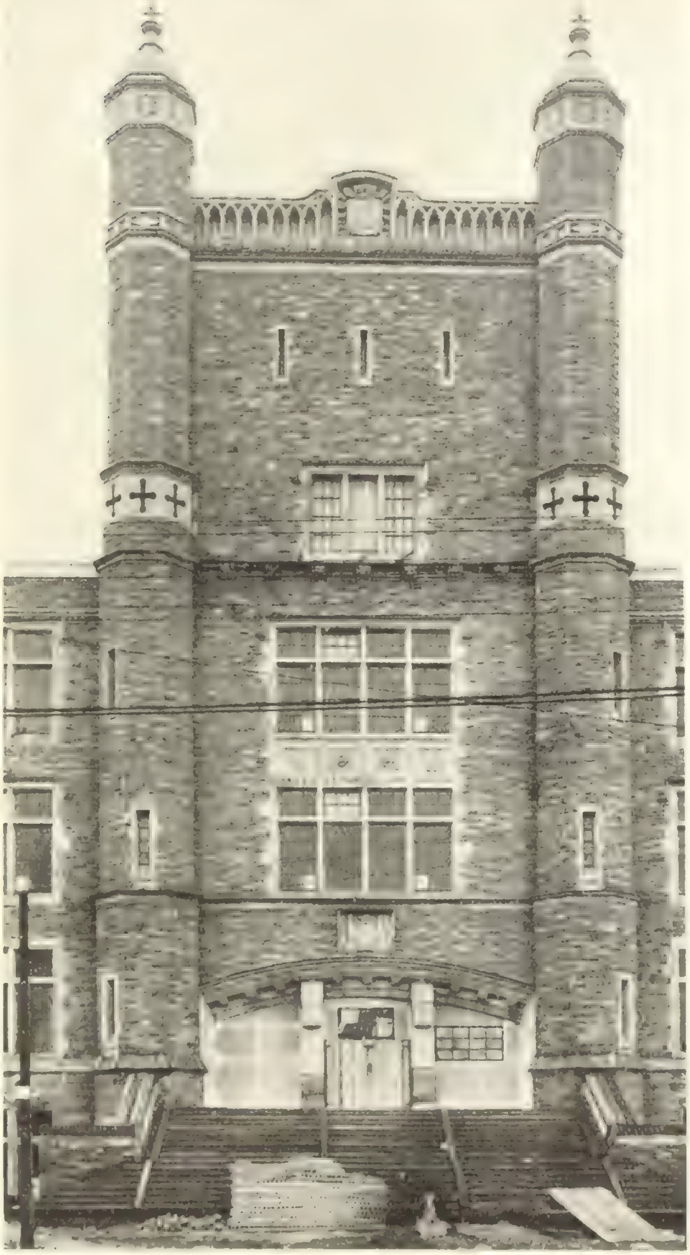

Promptly Executed

Main Entrance—Toronto Technical School

Cut Stone

The Indiana Buff Limestone in the above entrance was specially cut and supplied by us

While the raw material is imported this is strictly a "Made-in-Canada" product.

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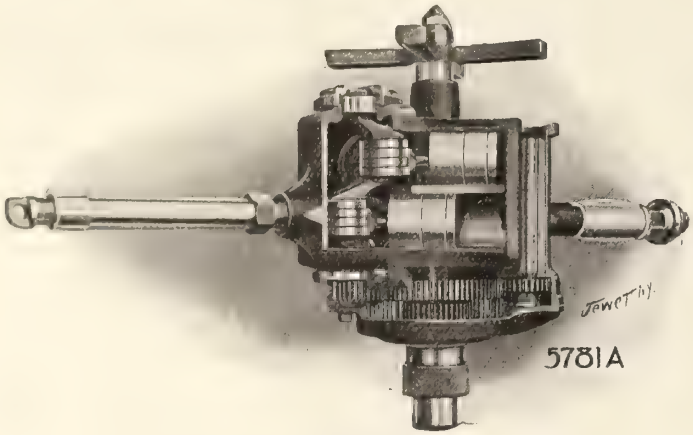
For Drilling, Tapping and Reaming Metals; For Driving Studs, Flue Rolling and for Wood Boring

USE "LITTLE DAVID" PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

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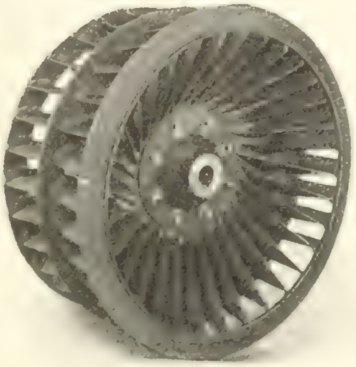

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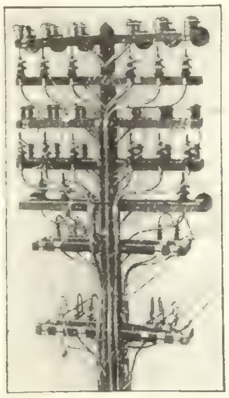

The Best Engineering Practice

in the installation of lead-covered cables of all kinds requires that the same care be given to protecting the insulation against moisture, etc., at the ends as at the joints in the manholes.

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provide this protection and their many exclusive and patented features have been suggested by our over 30 years' experience in the manufacture and installation of lead-covered cables of all kinds.

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; [illegible] $2.25, car lots, $1.55 on the track, [illegible] $1.95.

Lime—[illegible], white 40c per 100 lbs., delivered [illegible] less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 [illegible] job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, [illegible]; sand-lime brick, [illegible]; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $55 per M. Lots over 100,000, $50.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24. 12 x 24, 10 x 24, $45

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—[illegible] gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less [illegible] per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 66c. per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla. 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assinboine $1 extra.

Sand—For cement or brick work, delivered. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac. fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 70)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY LIMITED

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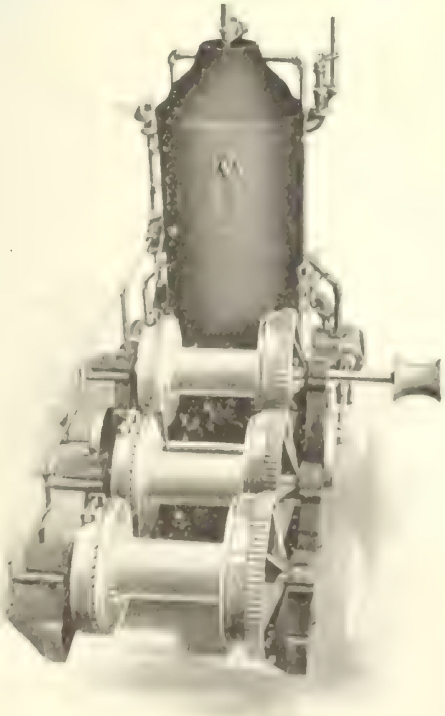

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Careful attention given all inquiries on repairs and special equipment

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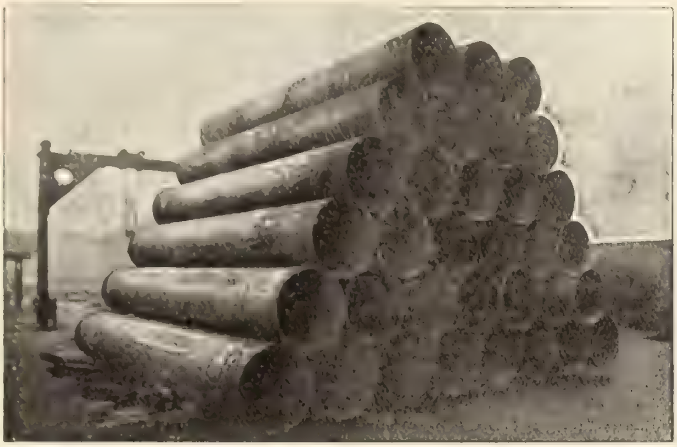

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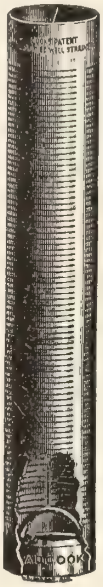

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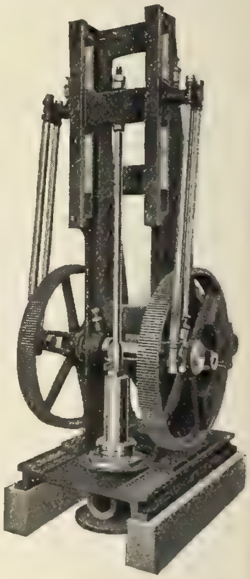

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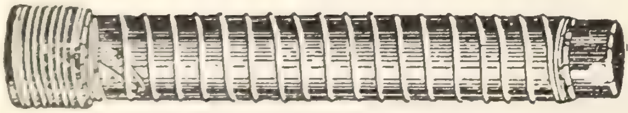

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Full Particulars and Estimates Furnished

RAILS New and Relaying Switches, Turntables, Etc.

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"PRESSED BRADFORD BRICK"
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They are the highest achievement in brick excellence.

"BRADFORD REDS"—our smooth brick, superb for facing fine residences and public buildings, as well as artistic fire places. Both dry pressed and impervious.

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The Bradford Pressed Brick Co.
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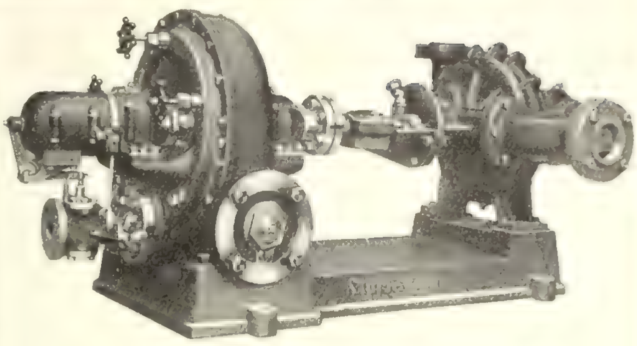

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When the phrase "turbine pump" is used, most people think merely of the pump. When they buy, they buy a pump. They usually forget all about the turbine which is driving it. The pump is the big detail—the important part of the set.

Sturtevant
(REG. CAN. PAT. OFF.)

Turbo Driven Pumps

are fundamentally correct. They are driven by the Sturtevant turbine—acknowledged as a machine that scarcely ever causes a shutdown. For the pump end, we buy the most suitable machine on the market for the particular job in question. We will furnish any standard make of pump which we feel we can stand behind and guarantee.

We cannot tell it all here, but if skeptical, read "How the Chief Engineer Was Convinced". It leads you through our big modern shop and shows why the Sturtevant turbine has such a good reputation. Send for your copy at once, mentioning this paper when writing.

B. F. Sturtevant Company
of Canada, Limited
Galt, Ontario
Montreal Toronto Winnipeg Vancouver

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 68)

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents, 4 in., 11 cents; 5 in., 16 cents, 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00, 24 in., $2.00

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton, Hammer Brand, $3 75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 13c. per ft.; 6-in. 25c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in., 40c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in., $1.50 ft.; 24-in., $2.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis: sisal rope, 11½c basis.

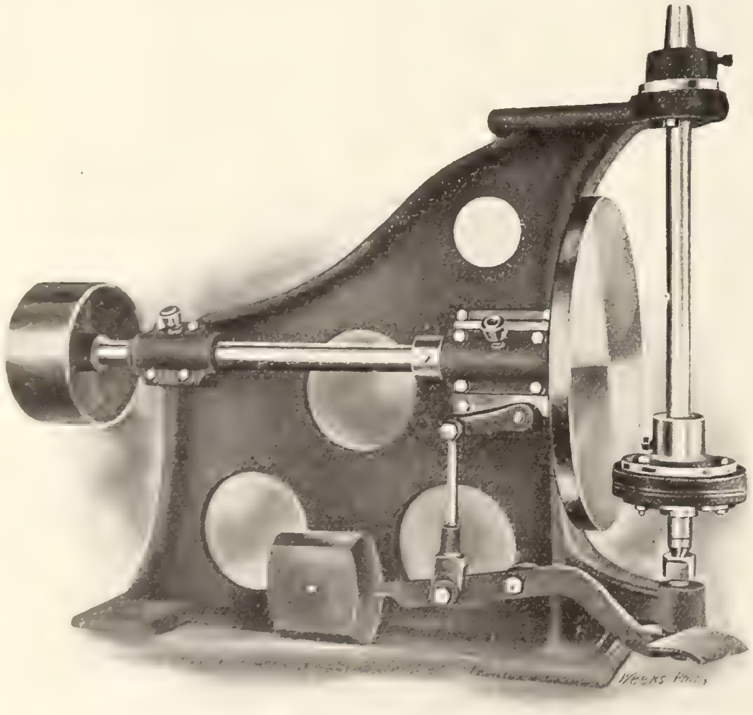
PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 82c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 80c. per gal.; red lead, dry, $8.00 to $9.50 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.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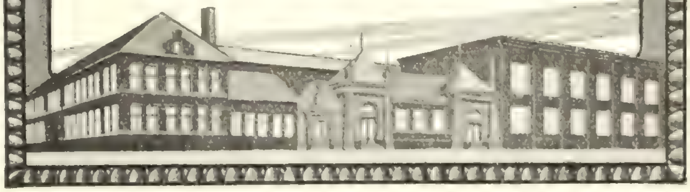

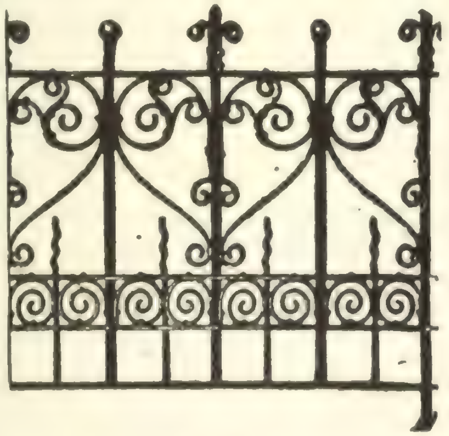

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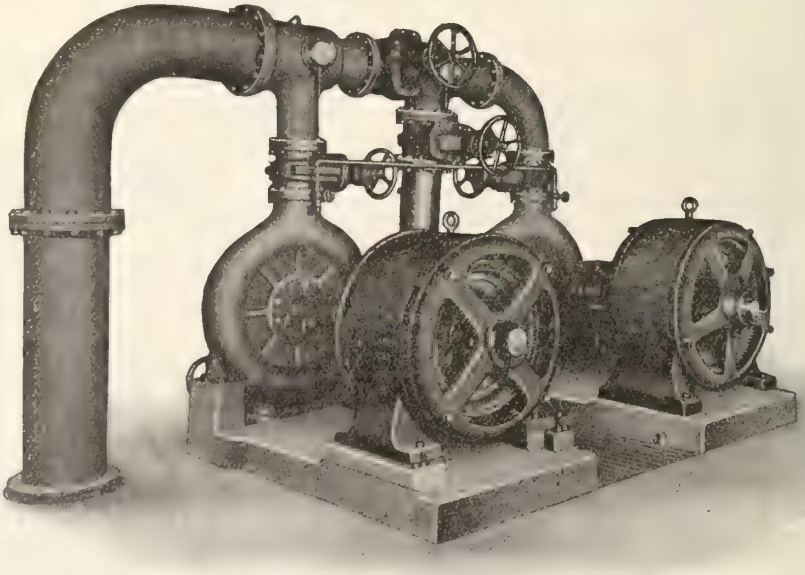

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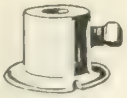


Fig. 1

Fig. 2

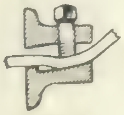


Fig. 3

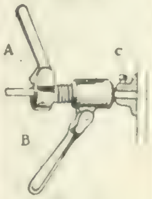


Fig. 4

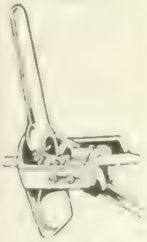
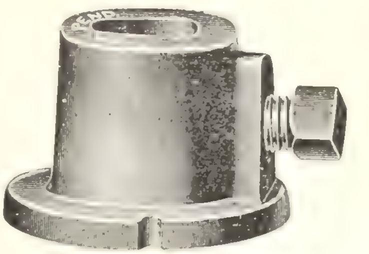


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screws tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

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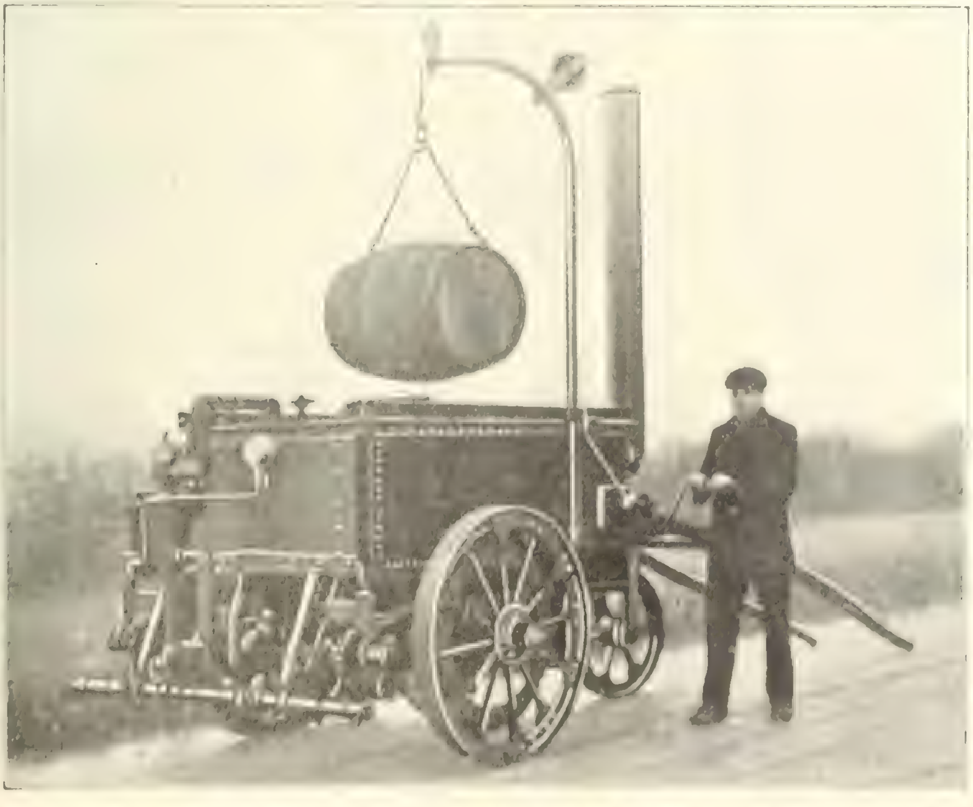

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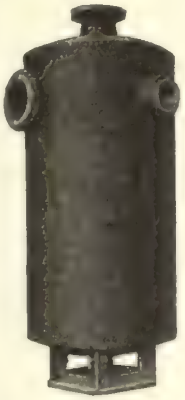

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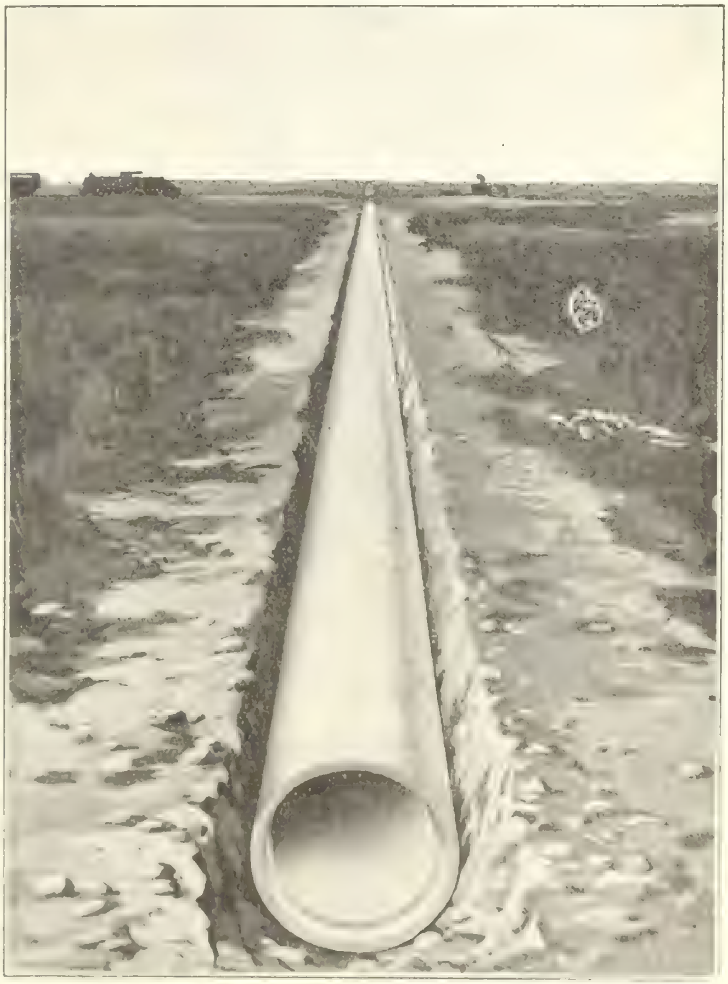

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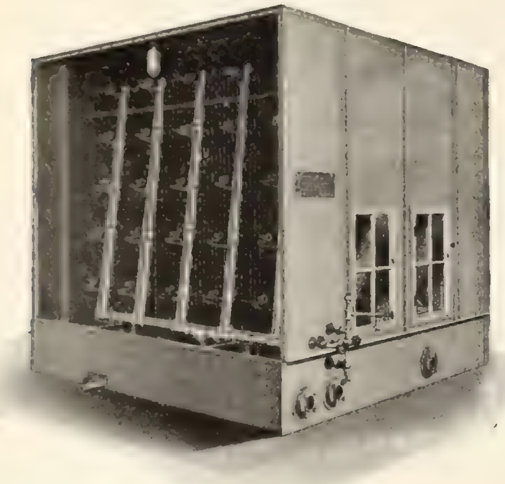

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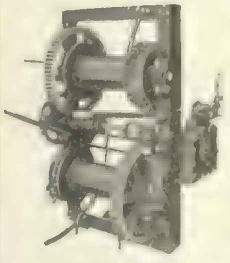
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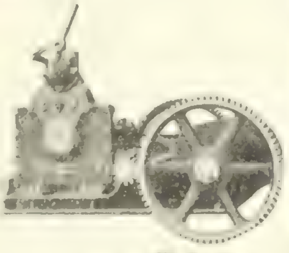
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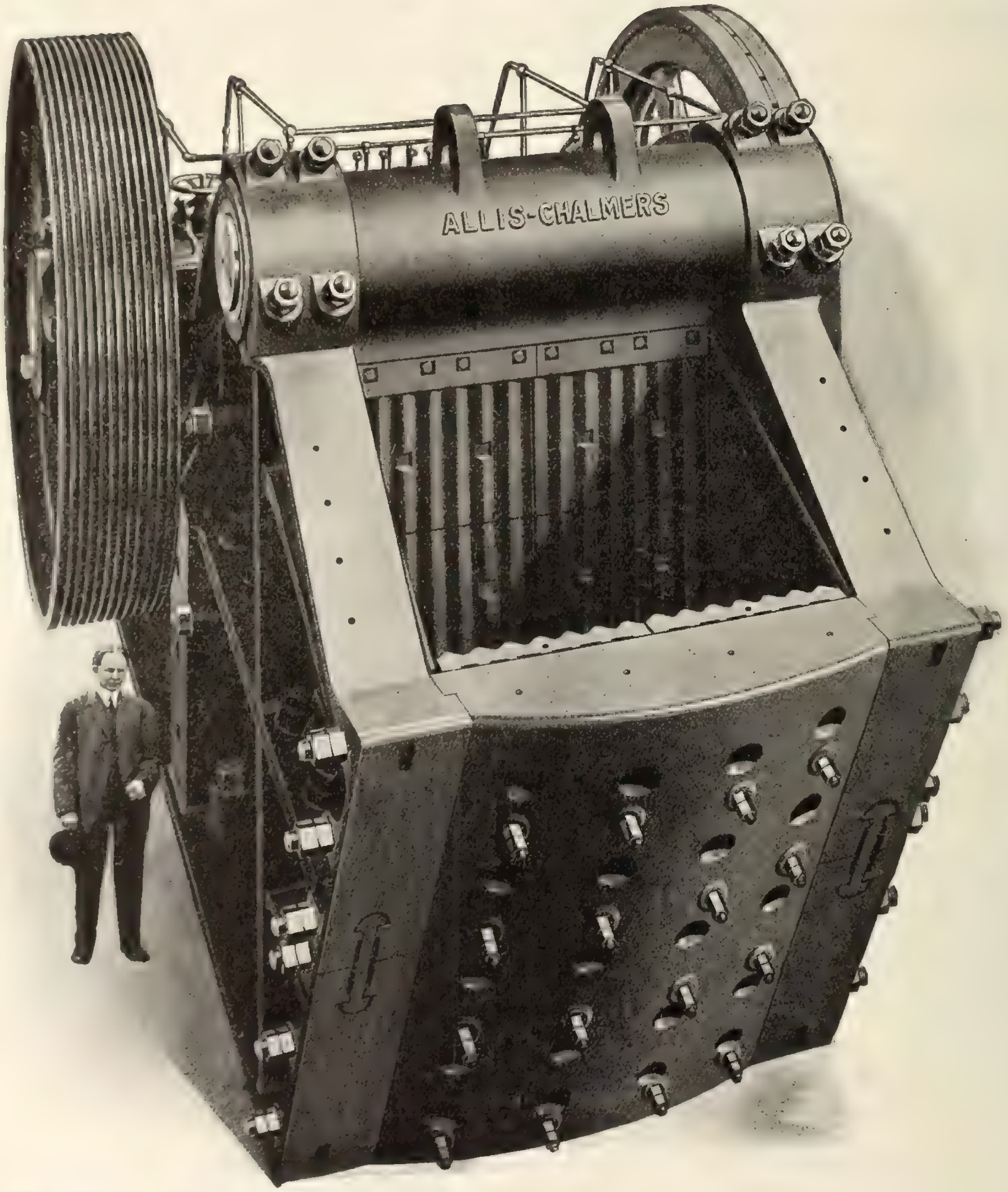

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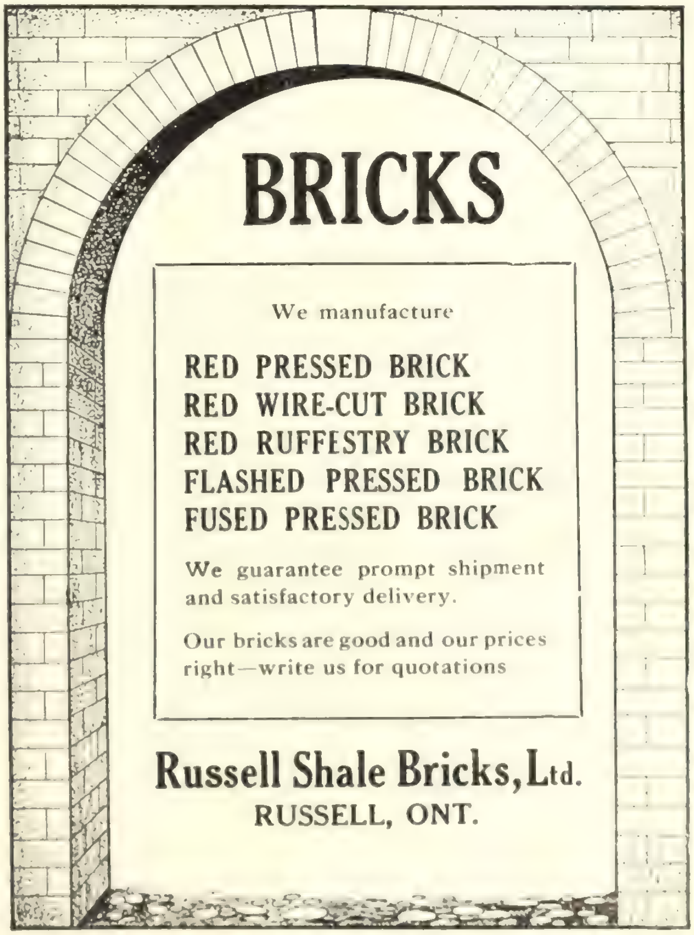

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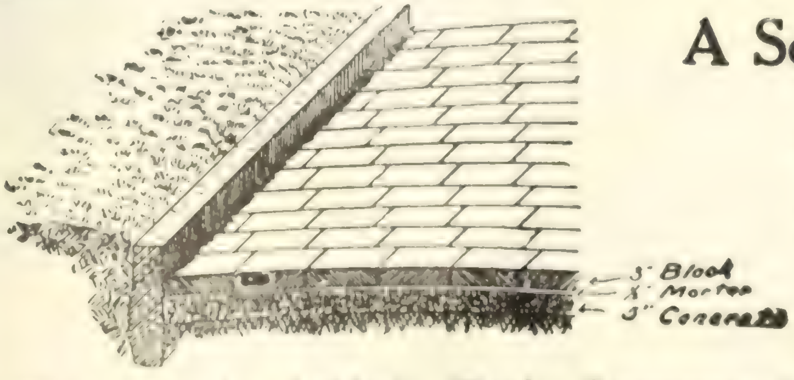

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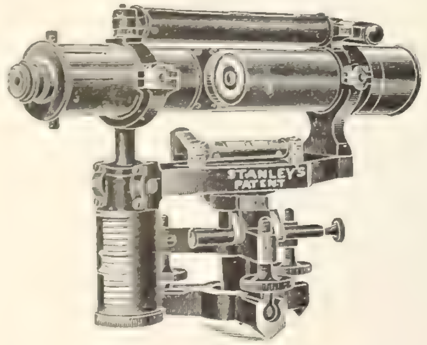

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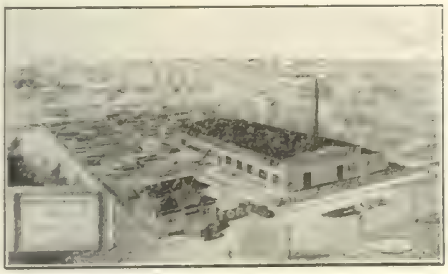

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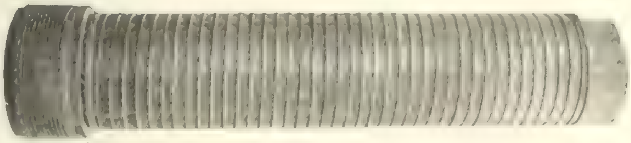

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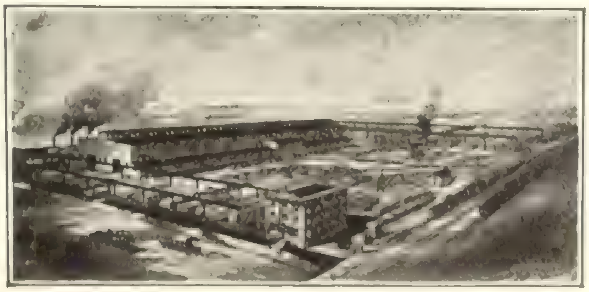

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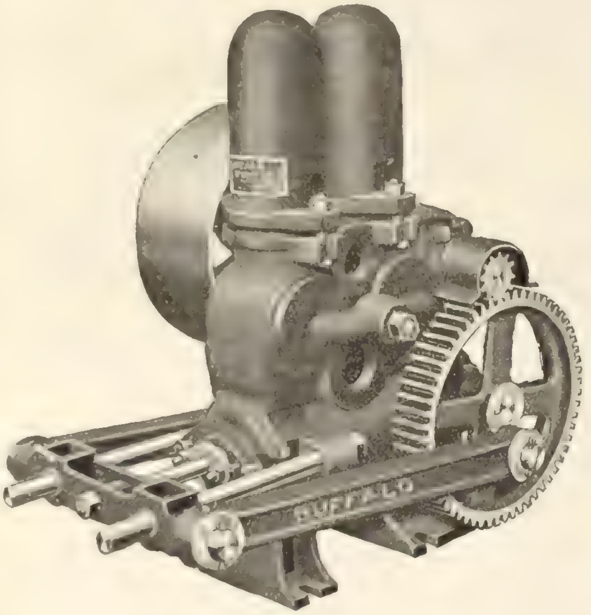

Fig. 401

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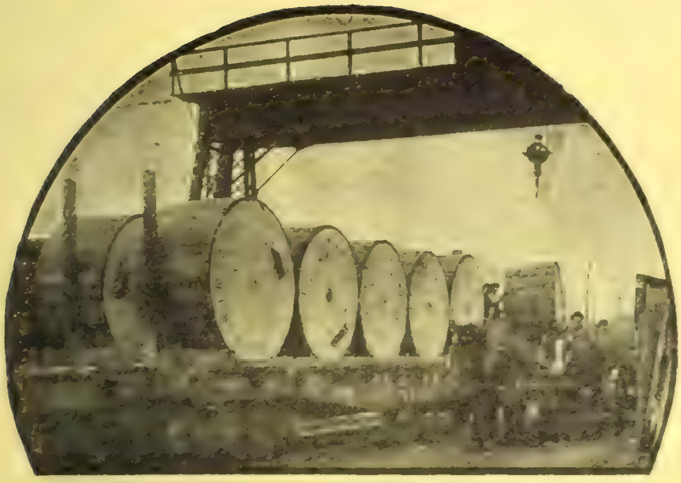

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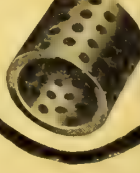

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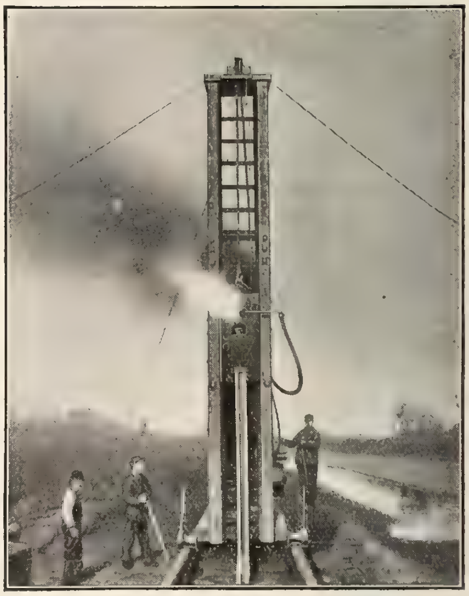

12 ton Mammoth down to 135 lb. Midget.

One of the ten sizes will fit your job and save you money.

CATALOGUE ON REQUEST

Mussens Limited

MONTREAL, 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

2,000 C. P.

For About Five Cents Per Hour

The Carbic Light

is the Cheapest, Simplest, Most Efficient Light.

No Waste.

The Carbic Light

is absolutely Non-explosive. Invaluable for Night Work, Tunnel and Trench Work.

CARRIED IN STOCK

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
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CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

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The following regulations apply to all advertisers:—Eighth page, two headings; quarter page, four headings; half page, eight headings; full page, sixteen headings.

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Lecky & Collis

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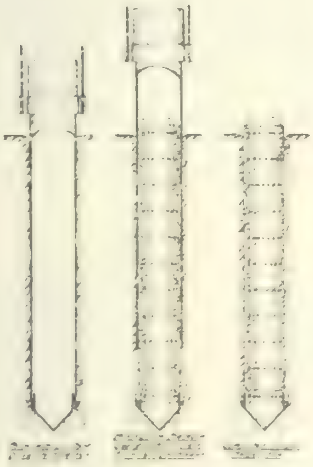
Solid As Gibraltar



THE SIMPLEX MOLDED PILE

for foundations for docks, wharves, sea-walls, etc., or for foundations through wet peat, or where very soft conditions prevail. The Standard Simplex form with the Cast Iron Point is driven to the required penetration as in the Standard System. A small quantity of soft concrete is introduced through the form, and on this as a bed, a molded reinforced concrete pile is lowered through the form, which is then, withdrawn leaving the molded pile in position.

Simplex Concrete Piles

Because a Simplex reinforced concrete pile may be driven any distance, it is always possible to place any foundation on hard pan or even bed rock. According to the load that is to be carried is determined the number of Simplex piles that must be driven. With this accurate technical information and the positive knowledge that each pile is a column of rigid concrete resting on bed rock any foundation however difficult may be made as "Solid as the Rock of Gibraltar".

Statistics show that two-thirds of all the made-in-place concrete piles in the world are Simplex piles.

Write for our 150 page concrete piling book.

Test load of 60 tons placed on one Simplex Molded Inserted Concrete Pile. Montreal Harbour Commissioners' Shed, No. 16 Pier. Total settlement 1 16 of an inch.

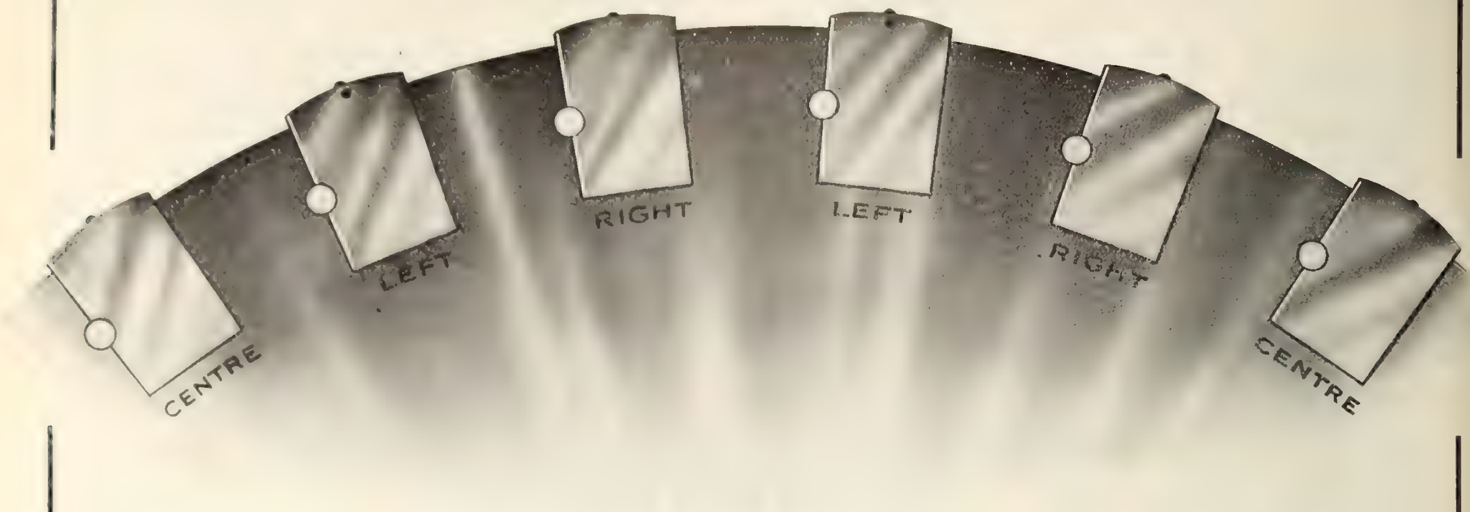
Simplex Concrete Piling Company, of Philadelphia

Canadian Representatives

SIMPLEX CONSTRUCTION

COMPANY, LIMITED

Coristine Building
MONTREAL



The steel is well worked into the smallest crevices of the diamond, with a welding heat.

Cut Stone Contractors

Save 70%

By filing the tooth down, thus the diamond will be found to retain its hold to the last shred of steel.

By equipping your Stone Saws with "ANDERSON DIAMOND TEETH" you are effecting a saving of 50% to 70% as the direct result of the superiority of our setting.

In recent tests in sandstone (the hardest stone on diamonds) our patent teeth ran eight weeks without the loss of a diamond while competitive teeth in the other blade of the same machine lost 30 diamonds in 8 days. We are prepared to supply to you Anderson's Diamond Teeth at prices varying according to the nature of the stone they are called upon to cut. Our latest achievement (which is a proved success) is that of using up your diamonds to the last shred, heretofore small stones or pieces have been discarded, we make teeth from them at a reasonable figure, eliminating all waste.

To interested parties we will gladly furnish full information.

George Anderson & Co.

of Canada, Limited
MONTREAL

TRADE MARK

Hull Iron & Steel Foundries, Limited

Head Office and Works - HULL, QUEBEC

Manufacturers of Steel Castings

Chrome, Manganese and Nickle Steel Castings

Annealed and Unannealed

Repair parts for Stone Crushing Plants, Mining Machinery and Cement Mills our specialty.

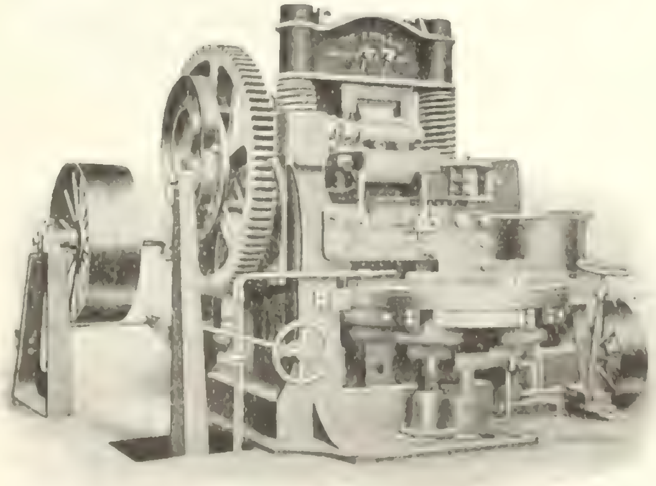
Machine Moulded Gears

any size up to 18 feet in diameter made without patterns.

We solicit your patronage and prompt attention will be given to any orders.

BRICK PLANTS

Lime-Sand
Clay, Slag,
Clinker,
&c., &c.



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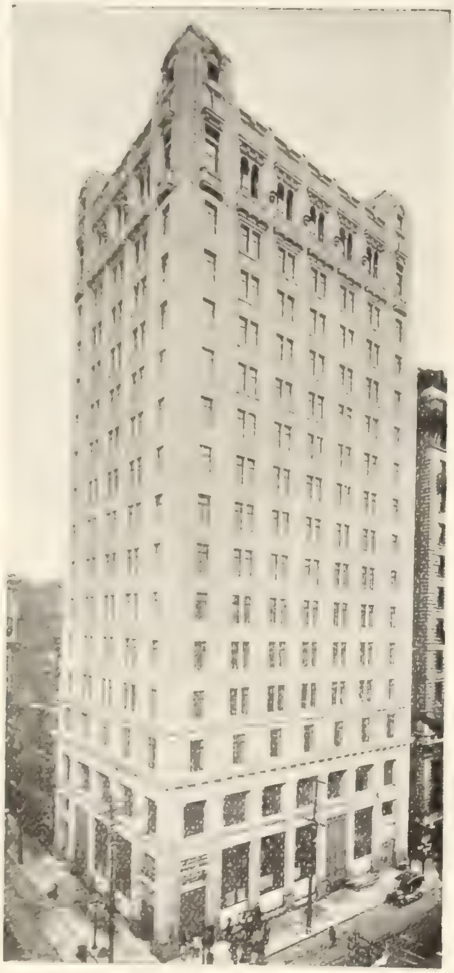
Complete
on Best
Lines.

World Wide Experience.

SUTCLIFFE, SPEAKMAN & CO., LTD. LEIGH,

CABLES – "Utilization Leigh" CODES – [illegible] LANCASHIRE, ENG.

THE NORTHWESTERN TERRA COTTA COMPANY



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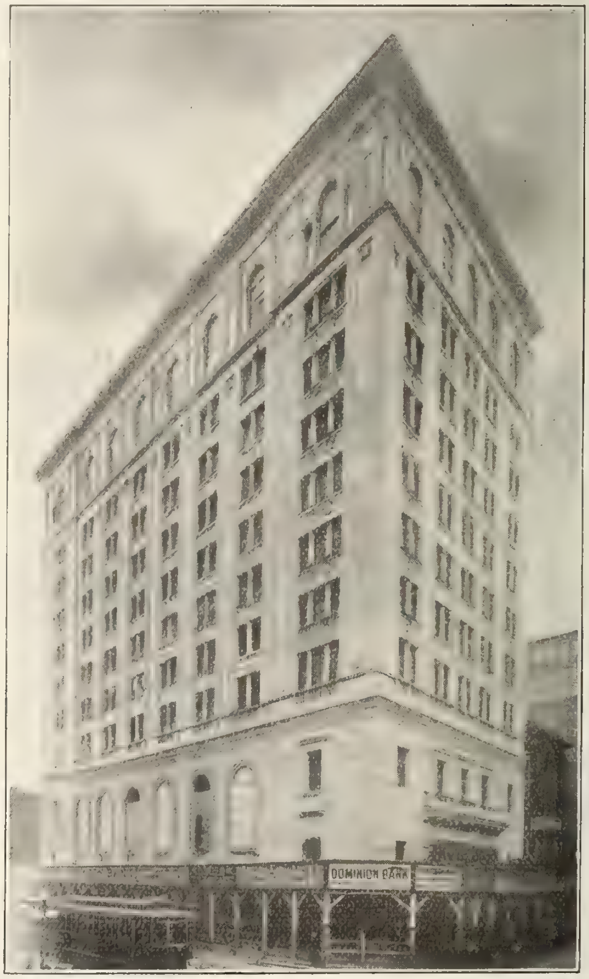
Darling & Pearson, Architects



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Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

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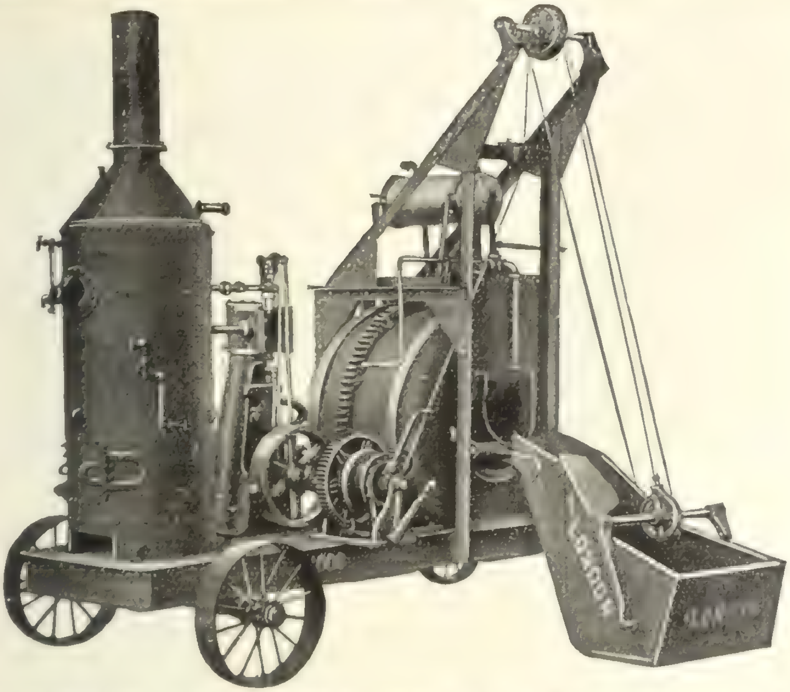
Agencies in all the large cities of Canada.



The London Concrete Mixer

A TRIUMPH OF SCIENTIFIC PRINCIPLES.

Once a Specialty—now a question of our output capacity

Our factory is working full time and we intend to work full time, no matter how long the war lasts. Contractors throughout Canada have learned that it is not necessary to go to foreign countries for their concrete machinery and London mixers are second to no other machines in the world. Our prices are less than those asked by smaller concerns, thanks to the contractors who are patronizing home industries in this time when foreign countries are mobilizing their forces with the intent to invade our markets.

We are the Largest Manufacturers of Concrete Machinery in Canada

THE LONDON CONCRETE MACHINERY CO., LTD.

Head Office and Factory : Cabell St. and Kitchener Ave., LONDON, ONT.

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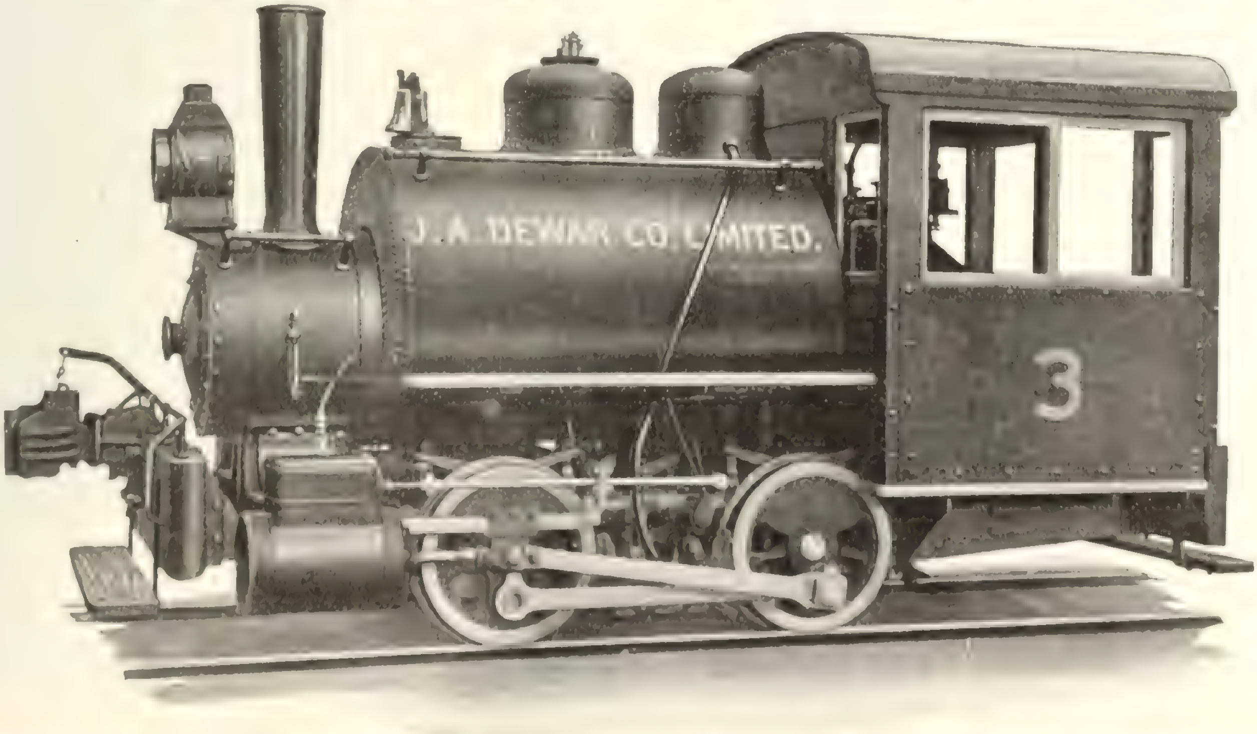

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years' experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

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Electric Air Rock Drills
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Electric Impulse Clocks
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Chipman & Power
Dominion Engineering & Inspection Company
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Mitchell, C. H.
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Browning Company
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(Continued on Page 14)

"Takes Up Little Room and Fills a Long Felt Want"—

This is an expression from a recent letter handed our Montreal Agents by Messrs. Brown and Vallance, Architects. It is significant of the general opinion of leading Architects throughout the Dominion as to the advantages of

The G&G Telescopic Hoist with compound gear and brake attachment

PATENTED

Made in Canada

For hoisting or lowering ash cans, kegs, barrels, cakes of ice, etc., between cellar and street level.

Raises a maximum load of 500 lbs. at a speed of 30 feet per minute by hand

Every G & G Telescopic Hoist is subjected to a working test before being shipped.

Does its work economically, safely, quickly.

Is operated from street level—protecting pedestrians from open trap and operator from any danger of being struck by falling load.

When not in use no part shows above sidewalk.

Adaptable to any building old or new.

A superior and economical method for Removing Ashes.

Write to nearest agent for Illustrated Booklet and Prices

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Toronto

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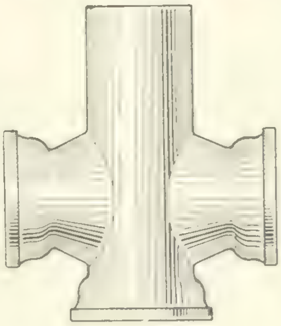
Warren

Cast Iron Pipe



Your requirements can be filled and your specifications carried out to the letter whether they be for standard or specials in cast iron pipe.

Large stocks always carried on hand.
Prompt shipments.

Warren Foundry
and Machine Co.
11 Broadway - NEW YORK

Woodhouse Chains for Contractors and Engineers have a great record

Thousands of experiments covering a term of many years, working in rock, gravel, coal banks — in construction work of a hundred different sorts—have demonstrated one great truth:

That Woodhouse Chains are Best by test and enduringly satisfactory

They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

Send for catalogue and prices

Woodhouse Chain Co., Trenton, N. J.

Specialists in Crane, Cable, Conveyor, Dredge, Steam Shovel, Block and other chains, standard measurements or made to measure.

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Pedlar People Limited
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Ferranti Electrical Mfg. Co.

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McDougall Caledonian Iron Wks.
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Beatty & Sons, M.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Hopkins & Co., F. H.
Lecky & Collis

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Canadian Buffalo Forge Co.
Sheldons Limited
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Excelsior Plate Glass Company
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(Continued on page 16).

MEXICAN EAGLE ASPHALT
TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
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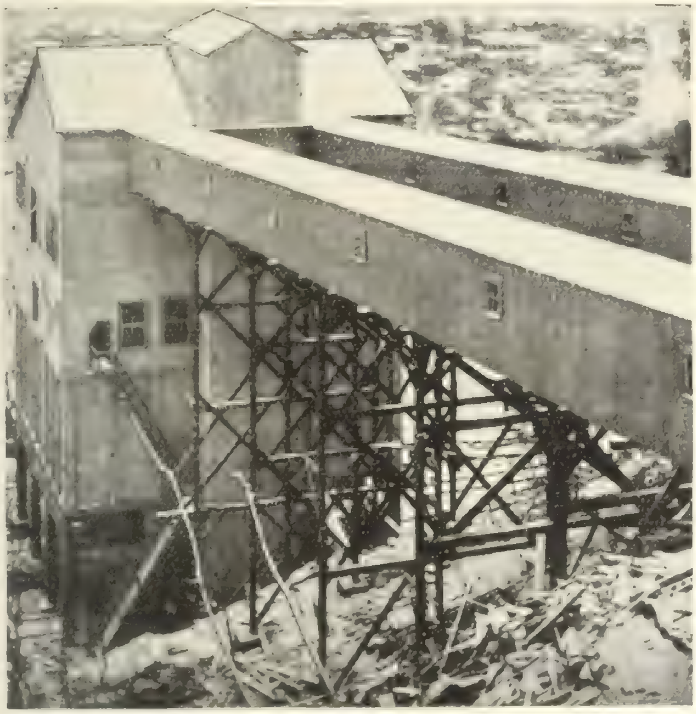
4—It has great cohesive strength.
5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it.
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited
Sole Canadian Agents for the Mexican Eagle Oil Co. Limited
103-107 Board of Trade Building :: MONTREAL



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All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

The BEST Results in Painting

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Preserves Roads
Prevents Dust~

Made in Canada

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Modern Pavement.

We didn't write this advertisement—

THE man who wrote this advertisement didn't know he was writing one. He simply stated facts in a letter, which we copy in full:

> Dutton, Ont., July 30th, 1914.
>
> Dear Sirs:
>
> For many years considerable money was annually expended on Main Street in the Village of Dutton with very unsatisfactory. results. The road was never good and at some seasons of the year it was almost impassable. In 1912 the Council resolved to undertake work of a more permanent character.
>
> After careful consideration it was decided to use vitrified brick for ten feet on each side forming a gutter, and for the center of the road crushed stone with Tarvia as a binder. The result is everything that can be desired. A two-year test has fully convinced us that the outlay has been one of the very best investments the Village has ever made. The road throughout is in as good condition as when the work was completed, if not better. We have one of the best streets in Ontario.
>
> Yours truly,
> J. H. McINTYRE, *Reeve.*

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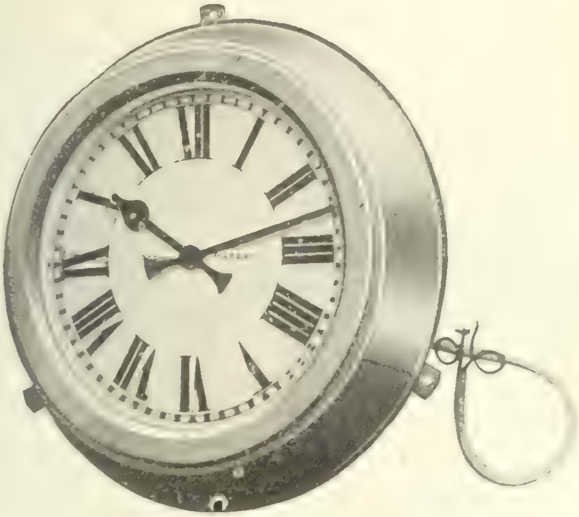

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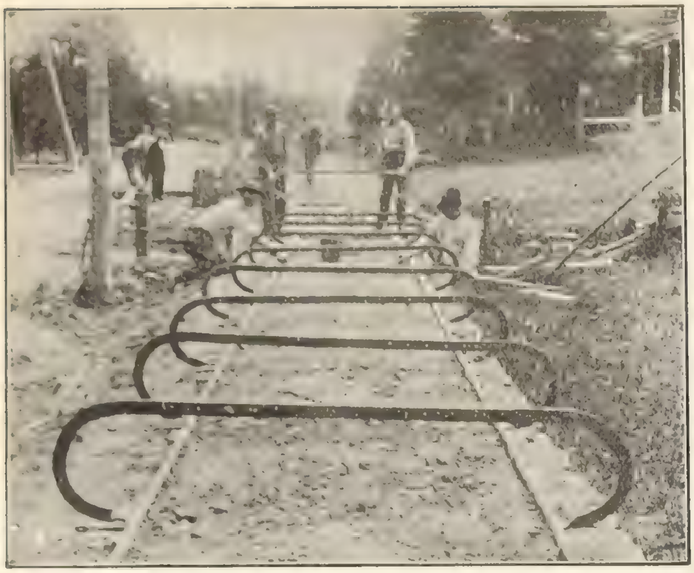

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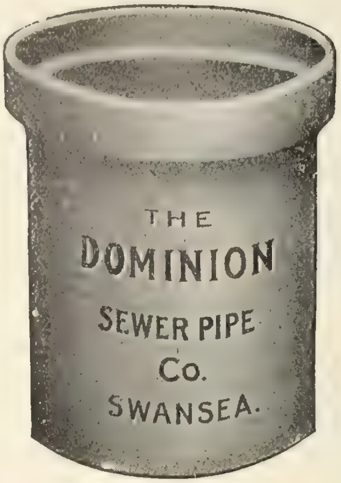

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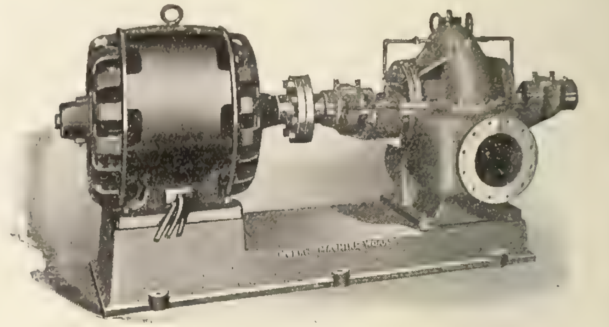

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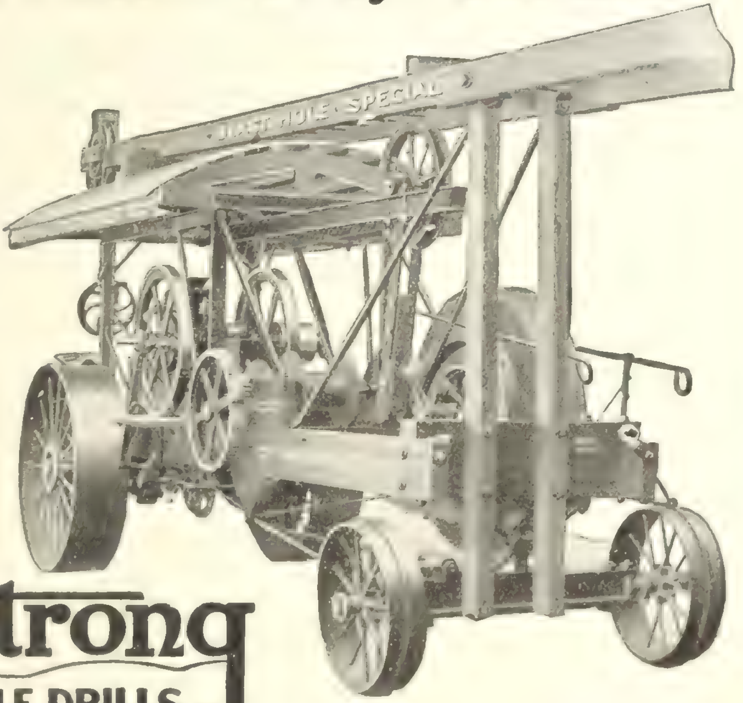

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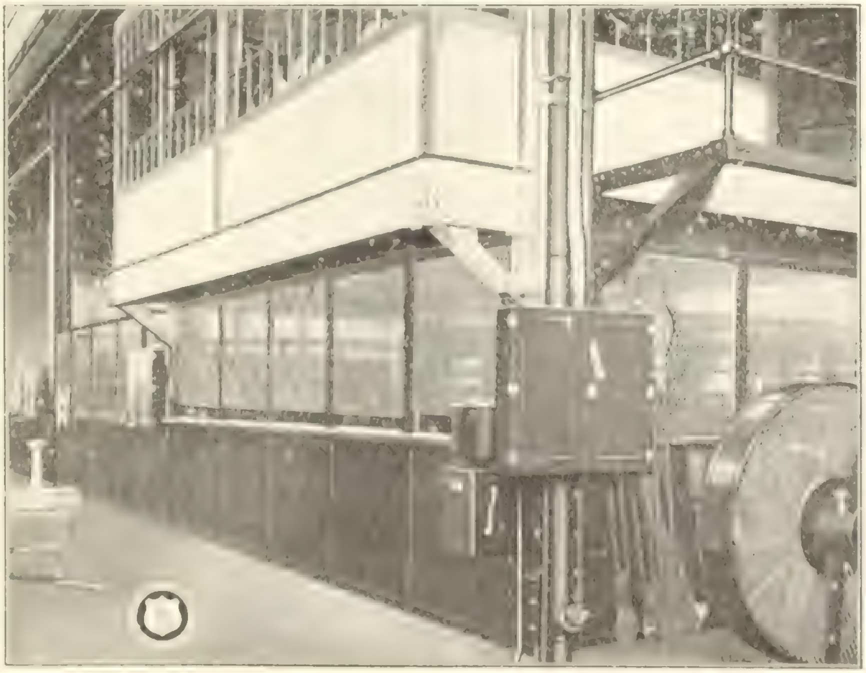

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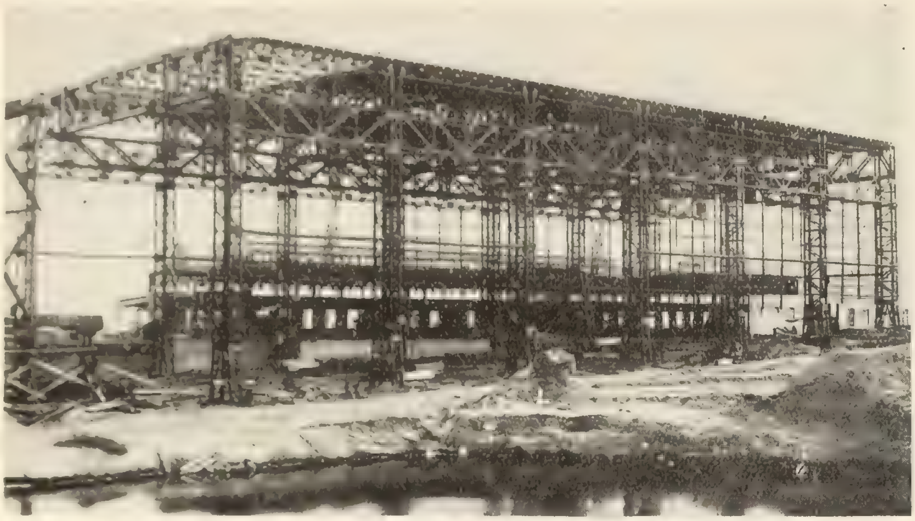

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Looking Ahead

IT were a much better thing for municipalities, instead of devoting their time to a consideration of little economies in the way of reduced expenditure, to look ahead and see what money they can save in next season's work by getting it in hand well ahead of time and arranging the preliminaries now. This question is a perennial one, but it is of special significance at a time when conditions are so favorable to the municipality and capitalist.

In the leading editorial of our issue of December 9 ("The Day of the Capitalist and of the Prospective Builder") we dealt at length with the advantages offering just now in the way of competition among contractors, the low cost of material and the surplus of available labor, and it is unnecessary to reconsider this aspect. In this article we are discussing an advantage that is attributable to no temporary condition, but to established practice, experience and foresight. We all know cities that muddle along through their constructional programme year after year and repeat the same old performance of getting their paving operations and sewer construction tied up by bad weather; so that it is refreshing to find that a certain city engineer of a city of some [illegible] people cleaned up [illegible] miles of paving (brick and concrete curb) in one season before bad weather set in. In this particular case we learn that bids were received on January 28, 1914, from sixteen contractors, who showed keen competition for the work. There was no delay in awarding the contracts and work was under way early in March. Thus there was the advantage of cheaper labor and teams and the use of sleds for hauling—"all of which," the engineer tells us, "was to the material advantage of the city in the lower prices for the work."

The contracts represented a total of 69,277 sq. yds. of brick paving and the work was completed by October 22 last. The sewers were built a year in advance of the paving, so that the trenches had plenty of time to settle before the paving over them was commenced. The contracts having been let in January they were the subject of much interest among local contractors.

OUR thoughts go out to our readers this Happy Christmas time, wishing them joy in all their deeds and days,—wishing them time for the task, wisdom for the work, peace for the pathway, friends for the fireside, and love to the last.

and an additional argument in favor of the whole procedure is that the streets were cleaned up before November, thus avoiding the danger to concrete occasioned by rapid and severe changes of temperature.

The case to which we have referred is not an isolated one. Harking back to last February, we recollect how the Maryland State Road Commission, in response to an advertisement (inserted about the end of January) for proposals on six contracts aggregating about thirty miles of road, received tenders from some fifty contractors whose bids totalled nearly one hundred. Surely there could be no better illustration of our point than this.

Dilatoriness is the bane of municipal life. Follow the procedure of the average council in the country, from the western hamlet to the eastern metropolis, and you will find the same governing characteristic of vacillation. This state of affairs is attributable, perhaps, to a basic defect in our form of government; but to whatever cause it owes its origin, responsibility should be placed directly on the shoulders of those who jeopardize the ratepayers' interests. City engineers and other civic officials must take a share of this responsibility whether their activities are directed by a competent or an incompetent council. **It is their business to know, and to let the council know, that the legal formalities and other preliminaries connected with public works must be arranged well in advance of the actual time of operations.** Too often these preliminaries are extended into the spring, with the result that there is unnecessary postponement and loss at the end of the season.

There is altogether too much procrastination in city construction departments, and a little lively action on the part of the local authorities, especially in the line of new work at a time when not too much is offering, would be refreshing. We look to our governing bodies for example, and our municipalities should take the lead in encouraging capitalists not only along the line of judicious expenditure but also in the way of foresight and getting the very best out of the work for the money put into it. This can only be effected by **looking ahead.**

Scholarly Originality in Architecture

(From the London Builder)

It is often maintained by designers of more confidence in their own skill than reasoning power that originality in problems of architecture implies a total severance from certain forms the origin of which is lost in the mists of tradition. These would-be arbiters of taste attempt at recurring intervals to alienate the sympathies of their less fortunate brothers from a study of historical motifs; they proclaim their dangerous enthusiasm for fresh adventure, yet every departure they attempt from the sequence of legitimate tradition ends in a burlesque of that which they profess to abhor.

Two definitions can be given to the term "originality"—each qualifies the other. In the first instance, the power to visualize the arrangement and proportion of an object or a group of parts depends entirely on a gift of concentration together with a profound knowledge of innumerable examples of like dispositions subconsciously carried in the mind as records of innumerable other circumstances. These impressions stored in the mind are so dimmed and blurred, and withal so great is their number, that it is impossible for them to be distinctly remembered; but on this depends the very soul of originality.

In the second instance, originality implies the power to variously modify, to readapt, to give new life to familiar shapes, to skim the surface of things and grasp their spirit; moreover, it means the power to recast universally accepted forms to meet new conditions without recourse to either caricature or eccentricity. In other words, originality is common sense allied to dexterity. But there remains a test even more severe for the designer who attempts the slightest variation from the orthodox—he must compare his work with other works of the highest reputation, and he must look upon all the masters of the past as dangerous competitors. If this theory is carefully followed the individual will gradually acquire a standard of impeccable taste; he will likewise comprehend the value of constructive criticism, which no true artist despises. All progressive art must of necessity be original; it invariably responds to the temper and spirit of the age which produces it. Great crises in the affairs of nations are eminently beneficial to originality; they are productive of disciplined art, which, moreover, is shorn of that undue luxuriance accompanying lengthy periods of peaceful prosperity. A glance at the picture which the nineteenth century offers affords the best illustration of the fluctuation of artistic ideals.

There should be no confusion of the terms "genius" and "originality." We have it on the authority of one of the foremost English essayists that "genius or originality is, for the most part, some strong quality in the mind answering to and bringing out some new and striking quality in Nature." In the latter regard it can be rightly argued that tradition is a convention of Nature.

The highly-strung artist whose temperament directs him to a pursuit of the ideal is the best qualified to dwell on the possibilities of scholarly original design. His knowledge of past achievement, however, must be of such a depth as to enable him to reject any theory unsympathetic with tradition. The ordinary man who dreams of airy castles almost attains to the status of an original designer, but such a one lacks the power to carry the given feeling into other situations, to convey the impressions of his imagination to paper and from that to the concrete. There are no rules governing the law of originality. The workings of the intellect in such circumstances are entirely by sympathy; there must be a passionate interest in a subject, a strong element of dissatisfaction, an even stronger desire to emulate and improve upon that which excites the fancy. Without passion there can be no original interest, none of that subtle and elusive charm, the attribute of all great works of art, which scarcely ever exists in the works of the present age.

A short time ago a brilliant writer and art critic who had gained some notoriety in the public press spoke to a gathering of architects. Most of the speaker's remarks were opposed to traditional sequence in the design of buildings; he ignored the theory of architectural composition, and bluntly told those present to be original. One illuminating sentence was, "Take ferro-concrete, and get something out of that."

As a champion of the modern school of amateurs this critic's arguments sounded plausible; but he, like many other gifted critics, was incapable of realizing that originality in design is a matter for slow development.

The Discourses of Sir Joshua Reynolds have stood the criticism of nearly a century and a half; nothing finer has been written on the subject of originality than certain of his remarks, which apply equally to architecture and painting.

In the second Discourse, given to the students of the Royal Academy, December 11, 1769, Sir Joshua said:—"A student unacquainted with the attempts of former adventurers is always apt to overrate his own abilities; to mistake the most trifling excursions for discoveries of moment, and every coast new to him for a new-found country. If by chance he passes beyond his usual limits he congratulates his own arrival at those regions which they who have steered a better course have long left behind them.

The productions of such minds are seldom distinguished by an air of originality—they are anticipated in their happiest efforts; and if they are found to differ in anything from their predecessors it is only in irregular sallies and trifling conceits. The more extensive, therefore, your acquaintance is with the works of those who have excelled the more extensive will be your powers of invention, and, what may appear still more like a paradox, the more original will be your conceptions. But the difficulty on this occasion is to determine what ought to be considered as the properest guides."

All through the Discourses there are other remarks equally to the point, but none elucidating the theory of originality in a simpler way. To the foregoing can be added a saying of Coleridge's, namely:—"To admire on principle is the only way to imitate without loss of originality."

If we make a careful survey of English architecture during the past three centuries—apart from the question of revivals of dissimilar styles—we find an amazing variety of forms not only in the development of composition, but in the attainment of original types of buildings. The best of the foregoing structures owe their inspiration entirely to the tradition which preceded them, plus a fusion with imported forms of antique classic, as well as an honest regard for the conditions of the period that witnessed their erection. Turning to the Gothic Revival of the last century, we find that the best works are indubitably those which in spirit closely approach the masterpieces of the Middle Ages; for examples, the buildings of Pugin, Pearson, and Bodley attain to an excellence comparable to old work. Yet when the influence of the Revival waned, and when the passion had almost exhausted itself, the rank and file of the Gothicists sought to express their taste in a style of free Gothic which in its vagaries is almost banal.

On the other hand, the originality of Vanbrugh's work has nothing in common with the polished manner we associate with Chambers. Neither would it be just to compare the exquisite finish of Cockerell's detail with the frenzied attempts of modern classic. We might be tempted to [illegible] with [illegible]—"All [illegible] in the application of appropriate forms to buildings seems now extinct, and Palladio set at defiance. He who can in the present day produce the newest and most extraordinary moulding in profiling an Order is the greatest genius."

An examination of the best modern architecture evolved to-day in America and France proves conclusively that the only original buildings in those countries are those which, in spirit at least, conform to traditional truths.

Publicity for Engineering Work

WIDER use of engineers in public service and the employment of well-recognized means of securing publicity for engineering work of a public nature were two points receiving special emphasis in a paper entitled "Some Factors in Municipal Engineering," read before the American Society of Mechanical Engineers in New York last week by Morris L. Cooke, director of the Department of Public Works, Philadelphia. In addition to these points Mr. Cooke discussed the need for expert advice in municipal work; the unfortunate restriction upon engineers in making expenditures, giving them no contingent fund for emergencies and research work; the absence of a financial program based on a consideration of the needs of the city over a considerable period; the impossibility of securing competent department heads through the generally accepted Civil-Service rules, and, finally, the advisability of establishing a municipal reference library, in which might be deposited copies of engineering reports that do not find their way into print, as well as copies of all printed documents of value to the municipal engineer. The following extracts from Mr. Cooke's paper, for which we are indebted to the Engineering Record, relate, however, only to the availability of engineers for public service and the value of publicity:

Role of the Engineer

The role which the engineer is to play in the development of our municipalities will depend primarily upon the attitude taken by the profession as a whole toward what appears to be a wonderful present opportunity and also upon the ability with which the work of the engineer is brought to the attention of the public. There is no real reason why municipal engineering should not be made to comprise most municipal undertakings.

The test by which the role of the engineer is to be determined will be the development in our profession of a genuine spirit of public service. The community is apparently ready to accord the engineer a leading, perhaps a controlling part, if the engineer will consider that in every decision and act there shall be the clearest possible recognition of the public interest.

There are certain kinds of engineering in which financial and almost all other kinds of preferment depend on an attitude of mind which, while not necessarily anti-social does not provide sufficient opportunity for entertaining a virile public point of view. As a representative of public, rather than private interest, it is my duty in choosing the advisers of the city which I have the honor of serving to satisfy myself not only as to the ability of those we employ, but also as to their disinterested—yes, their public point of view.

Lack of Qualified Men

Judged by this standard, there are in certain fields of engineering almost no engineers who are at present available for the service of the public and who at the same time have had sufficient experience for large undertakings. In the past few years we have had unusual opportunities for seeing at close range the professional attitude of those equipped with the technical knowledge required in advisers to cities on utility matters. It has been practically impossible [illegible] services of those with reputations already made in the electrical field. Some of our experiences could be considered on the whole rather amusing were it not for the fact that we are left under the obvious conclusion that for the average city official to get good advice on these matters, is well nigh impossible. What is more objectionable is that this condition is one quite generally recognized as true by city officials. We hear a good deal of complaint on the part of engineers that as a profession we are not chosen more frequently to serve on public service commissions and for similar technical work. Perhaps in our experience may be found at least part of the reason for this condition. Of course when a city wants advice on a subject such as this the matter is usually one of considerable importance, often involving large sums of money, and in reaching conclusions the city official should not be dependent for advice on junior members of the profession.

The same tendency is to be noted in other branches of our profession. An eminent authority on concrete, who is in intimate touch with the men who are practising in this line, was recently asked for the name of an engineer who was not in any way affiliated with the large manufacturers of this material and after considerable study was able to think of only one man. There is nothing necessarily improper in this situation —it may simply mean that all the competent men in this line receive retainers from manufacturers. Some months ago I wanted to retain an engineer fully posted on the details of a certain sub-division of railroad operation. It was extremely difficult to find a man without recognized affiliations which would preclude his retention. Again I am informed that there are no asphalt experts who do not receive retainers from the manufacturers. It is a condition which should be provocative of thought by engineers.

I would not have you think that I do not fully appreciate that our present situation is the natural outgrowth of the fact that all of the foremost engineers have become prominent through the service of private interests. Public employers up to the present have been almost a negligible factor in furnishing opportunity for employment or for the making of a reputation. It is perfectly natural, and it is in accord with former ideals, that engineers should feel their first duty to be to these private employers. But in this time of broader and deeper social consciousness it seems to me that this standard must change.

Magnitude of Opportunity

In inviting the attention of our profession to the municipal field, we are apparently opening the door of opportunity to tens of millions of dollars' worth of work which is not now either considered engineering nor carried on by engineers. The municipal field is almost virgin soil so far as engineering is concerned. As recently as ten years ago the problem of snow removal which is being discussed as a part of this day's program, was so absolutely in the hands of thumb rule, and in many instances even of inexperienced men, that it is probably true that in no city in this country was it being attacked either by engineering methods or by engineers. Yet it will not be denied that on work of this kind, in which one city spent nearly $3,000,000 in six weeks last year, there is in reality an engineering problem of considerable magnitude.

If this municipal field is to be one in which engineers of ability, sincerity of purpose and high ideals are to find a permanent and satisfactory outlet for their energies, our profession acting as a profession will be one of the main agencies bringing about certain fundamental changes in the attitude of the public. In the minds of too many engineers, participating collectively in matters pertaining to municipal engineering means "getting into politics." Architectural work being a part of the business of the Department of Public Works in Philadelphia, we have had the co-operation of the American Institute of Architects and of its Philadelphia chapter from the beginning. We have made many demands on them and in every case have met with generous enthusiastic response. This assistance has been entirely apart from the help rendered us by individual architects. We have had the constant, indefatigable and valuable support of the secretary of the American Society of Mechanical Engineers in our efforts to maintain the highest professional standards in the work of the department. But engineering bodies as such have given us no assistance and, so far as I know, have taken no part in the discussion of federal, state and municipal engineering, except in the matter of conservation, which for some reason is considered as innocuous from an engineering standpoint as a prayer-meeting.

Publicity

I am not one of those who feel that all our shortcomings are "the fault of the people." I would rather assume my share of the responsibility for conditions as they are and then join with my professional associates and the community at large in bettering them. If we engineers are to have any prominent part in this there are fundamental changes which we shall have to make in our own equipment for the work. In the first place, we have to get rid of the now old-fashioned idea that advertising is a crime. I admit that as a part of my work as a public official I put in a great deal of thought on what may be quite properly called advertising. By that I mean that I pay less attention in my reports to dignity of form and diction than to making them sufficiently interesting to be read. It is only as we engineers who are public officials learn to make the public, sometimes against its will, understand our work, that we are to get that degree of popular support for it which will make it possible for it to be done in an efficient manner.

In my opinion it is going to become more and more a necessity, not only in public but in private work, for engineers to be able to popularize what they are doing. It is true to-day that a man who wants to do really good and efficient work can do so only after an aroused public opinion. You cannot drive people in a democracy. So I admit that in offering employment to an engineer, other things being equal, I want what might be called a good advertiser. You can secure appropriations for work more easily when it is well advertised. The Panama Canal is a good example of this principle. Again, advertising is the best possible check against ill advised expenditures. In building our Byberry and Bensalem service-test roadway we erected sign-boards on each of the 26 sections giving to the layman the exact method of its construction in non-technical language. If the public know how a street is supposed to be constructed or cleaned, you do not require as many paid inspectors on the job.

Development of Public Opinion

The development of some varieties of municipal engineering is absolutely dependent upon the development of public opinion and must proceed with it. The matter of street cleaning is largely a question of an improved public taste in the matter of street paving. Unless streets are well paved they cannot be well cleaned except at a prohibitive cost. To jump from one degree of cleanliness in this respect to another without a supporting public opinion may be enough to wreck an administration and to set the tide of civic improvement running in the opposite direction.

The newspaper is the great educator in these matters to-day. But we are already using in Philadelphia moving pictures, parades and exhibitions. The possibilities of these and other means of publicity are not yet fully understood.

Again, more effort must be put into humanizing public administration. The engineer shares with those who have had the opportunity for education, the mistaken idea that the man at the top is in a position to tell the man at the bottom what is good for him. The fact that our country was founded and has been perpetuated on the contrary idea has not seemed to affect the situation very much.

Take, for instance, the movement which has led to the formation of large numbers of business men's associations and improvement associations. I have found these associations ready and anxious to hear from men who had definite knowledge on matters of public interest. It should be the attitude of any engineer to affiliate with one of these organizations and to help to make it an influence.

Floors for Steel Highway Bridges

By Clifford Older, A. M. Soc. C. E.†

DEFINITE statistics in regard to the number and length of highway bridges for any considerable mileage of highways are difficult to obtain and are not at present available. In some states, however, we are able to ascertain the amount of the total expenditure for bridge-work of all kinds. Available information of this kind seems to indicate that approximately one-half of the funds raised for ordinary road and bridge purposes are expended in the renewal and maintenance.

It is evident, therefore, that if maintenance expenditures are to be reduced to the minimum, highway bridges and bridge floors must receive careful consideration.

Judging from conditions in Illinois, it is probable that at least 90 per cent. of all existing highway bridges are provided with nothing better than plank floors, and that the maintenance of these floors costs approximately 15 per cent. of the total expenditure for road and bridge maintenance, or about $10.00 per mile of road per annum.

Floors for New Bridges

It is a simple matter to provide sufficient strength in the design of a new bridge, to accommodate any of the various modern types of floors or wearing surfaces.

It seems desirable to select a type of floor which will permit the use of a wearing surface of the same kind as that on the adjacent highway, so that the same method of maintenance may be used on the bridge floor as elsewhere.

The difference in weight of various types of floors has little effect on the design and cost of concrete bridges. Steel bridges, however, are materially affected in both design and cost, by a comparatively small variation in the weight of the floor. The saving in the weight and cost of the steel in the trusses and floor system for the lighter floors may outweigh the advantage of having the same wearing surface on the bridge as elsewhere on the highway. Floors for steel bridges only will be considered in this discussion.

It is desirable to provide an independent wearing surface so that although the pavement may be worn practically through, the bridge may still carry traffic with safety. The bridge floor should then preferably consist of two elements: the sub-floor, which should be as permanent as the bridge superstructure and should provide the necessary strength to transmit the highway loads to the floor supports, and a wearing surface of such character as to permit of economical maintenance.

In considering construction materials for both these elements, the matter of weight increases in importance with the length of span. For sub-floors of the more permanent type, buckle plates with concrete covering, reinforced concrete, and creosoted plank cover the field. For wearing surfaces, brick, concrete, creosoted blocks, macadam, gravel, mixtures of bituminous materials with sand, gravel or stone, plank, ordinary soil and practically all other varieties of surfacing materials have been used.

In comparing costs, it is necessary to consider not only the cost of the floor and its maintenance, but also the effect of the weight of floor selected on the design and cost of the remainder of the bridge.

Classification of Floors with Respect to Weight

For the purpose of considering the effect of the weight of the floor on the design of the superstructure,

Concrete sub-floor ready for wearing surface

Concrete sub-floor—macadam wearing surface

Paper presented at the Annual Convention of the American Road Builders' Association [illegible] Chicago.

† Bridge Engineer, Illinois Highway Department.

Creosoted plank sub-floor—brick wearing surface.

the various types of floors are herein grouped in four classes.

Class A Floors.—Floors which weigh approximately 100 lbs. per sq. ft. of roadway surface are included in Class A. Floors consisting of a reinforced concrete sub-floor, assumed to weigh 50 lbs. per square foot, on which is placed a wearing surface of concrete, brick, macadam or gravel, are of this class. The wearing surface is assumed also to weigh fifty lbs. per sq. ft. of roadway surface.

Class B Floors.—Floors which weigh approximately 65 lbs. per sq. ft. of roadway surface are included in Class B. Floors consisting of a concrete sub-floor, with a creosoted block wearing surface and floors consisting of creosoted plank sub-floors with a brick wearing surface, are of this class.

Class C Floors.—Floors which weigh approximately 32 lbs. per sq. ft. are included in Class C. Floors consisting of a creosoted plank sub-floor with a creosoted block wearing surface, are included in this class.

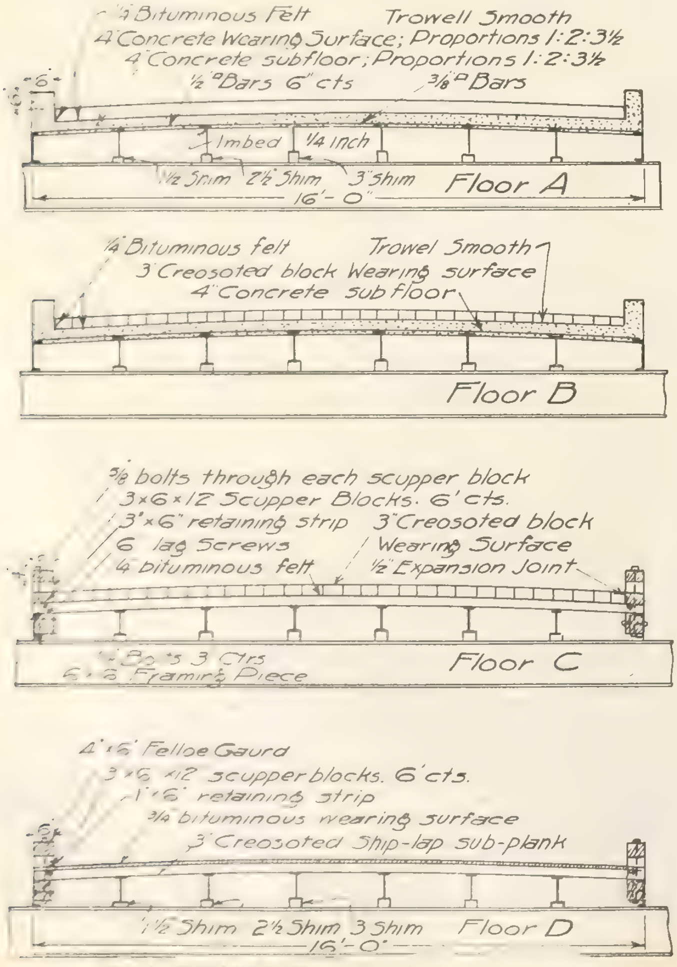


Fig. 1—Standard Floors—Illinois Highway Department.

Class D Floors.—Floors which weigh approximately 26 lbs. per sq. ft. are included in Class D. Floors consisting of a creosoted plank sub-floor with a wearing surface about three-fourths of an inch thick, composed of a mixture of gravel and bituminous material, are of this class.

Buckle plate floors are not considered, as they weigh as much and cost more than concrete sub-floors.

Description of Floors Illustrated

Fig. 1 shows standard designs used by the Illinois Highway Department for the floors above mentioned. The creosoted plank sub-floors (Floor C and Floor D) are crowned by bending the plank over the stringers and anchoring the ends to the nailers by means of lag screws. The creosoted blocks (Floor B and Floor D) are laid on a ¼-inch bituminous felt cushion, which is coated with asphalt immediately before laying the blocks. Shiplap sub-plank are used for floors having a bituminous gravel wearing surface. The use of this form of sub-plank has been found to be the cheapest and most effective method of preventing the leakage of the bituminous material.

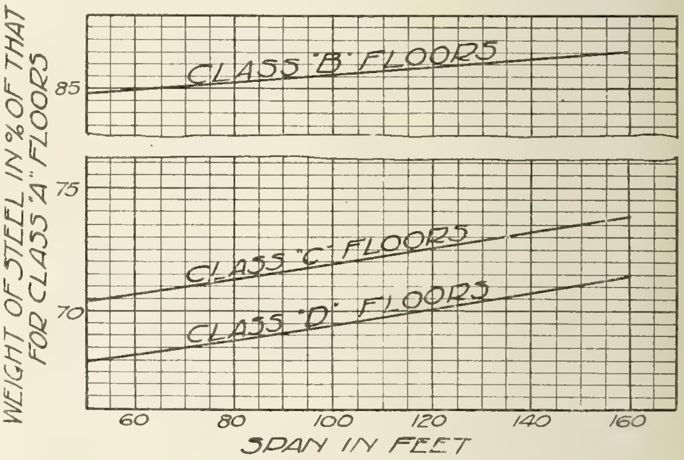


Fig. 2

Explanation of Curves

The curves (Fig. 2) show the weight of the structural steel in bridge superstructures as a per cent. of the weight of the steel in superstructures having Class A floors. That is the weight of superstructure steel in bridges having floors weighing 100 lbs. per sq. ft. is taken as 100 per cent., and the weight of steel required for the lighter floors expressed as a percentage of this weight.

These curves are based on the weight of steel in spans which conform to the standard designs of the Illinois Highway Department. The designs used provide for 16-foot roadways. The curves were checked at a number of points, however, for 18-foot roadway designs and were found to conform very closely. These curves are sufficiently accurate to enable a designer to determine the relative cost of steel superstructure having floors of various types and weights.

The curve (Fig. 3) is based on the curves (Fig. 2) and shows the average per cent. variation in weight of steel for a variation of ten lbs. per sq. ft. in the weight of the floor.

Fig. 4 shows the average contract price for the Illinois Highway Department standard 16-foot roadway steel spans with floor complete.

For spans up to 80 feet inclusive, rivetted pony trusses are used. For spans from 90 to 160 feet, rivetted Pratt trusses are used. This range of span length covers at least 90 per cent. of the highway bridges in Illinois.

The average contract price of materials is as follows:—structural steel complete in place, \$.03½ per lb.; concrete sub-floors, including reinforcing steel, \$12.00 per cu. yd.; concrete wearing surface, 4 inches think, 90c. per sq. yd.; creosoted sub-plank (12-lb. treatment) complete in place, \$70.00 per thousand feet board measure; creosoted block wearing surface, \$1.80 per sq. yd.; bituminous gravel wearing surface, 60c. per sq. yd.

The average cost of sub-floor and wearing surface per foot of 16 feet wide roadway (1.78 sq. yds. including curbs) is as follows:—concrete sub-floor with concrete, wearing surface (weight 100 lbs. per sq. ft.) \$4.25 per ft. of bridge; concrete sub-floor with creosoted block wearing surface (weight 65 lbs. per sq. ft.), \$5.80 per ft.; creosoted plank sub-floor with creosoted block wearing surface (weight 32 lbs. per sq. ft.), \$7.30 per ft.; creosoted plank sub-floor with bituminous gravel wearing surface (weight 26 lbs. per sq. ft.), \$5.15 per ft.

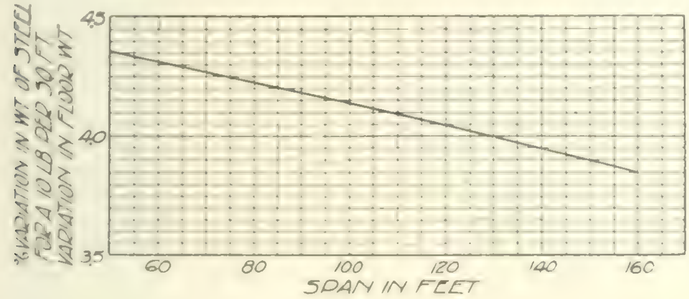


Fig. 3

It seems probable that under average conditions the length of life of the floors represented by the upper three full line curves may equal that of the remainder of the superstructure and that the cost of maintenance for this period would be small.

The experience of the Illinois Highway Department seems to indicate that under average conditions the bituminous wearing surface requires a light treatment of oil and stone chips or screened gravel, at intervals of about four years at a cost of about ten cents per square yard and a probable complete resurfacing once in about twelve years at a cost of approximately 60c. per square yard. This amounts to 7½c. per square yard, per annum. Adding to the first cost of the bridge, the maintenance charge capitalized at 6 per cent. Curve D, Fig.4 results. The position of this curve indicates that it would be preferable to use creosoted block or other floor in building new structures.

Probably 95 per cent. of existing steel highway bridges were originally designed for ordinary plank floors. Under average conditions and at the present price of yellow pine, which is the material now quite generally used, the annual cost of maintaining such floors is about [illegible] per square yard. The first cost plus the maintenance charge capitalized at 6 per cent. results in curve E, Fig. 4.

Conclusions

It is evident that ordinary plank floors having an average life of not more than three and one-half years are to be avoided when possible.

It is to be noted that with the exception of the floor with the bituminous surface, the cost of the floor increases as the weight decreases; and yet the cost of the entire superstructure decreases as the weight of floor decreases.

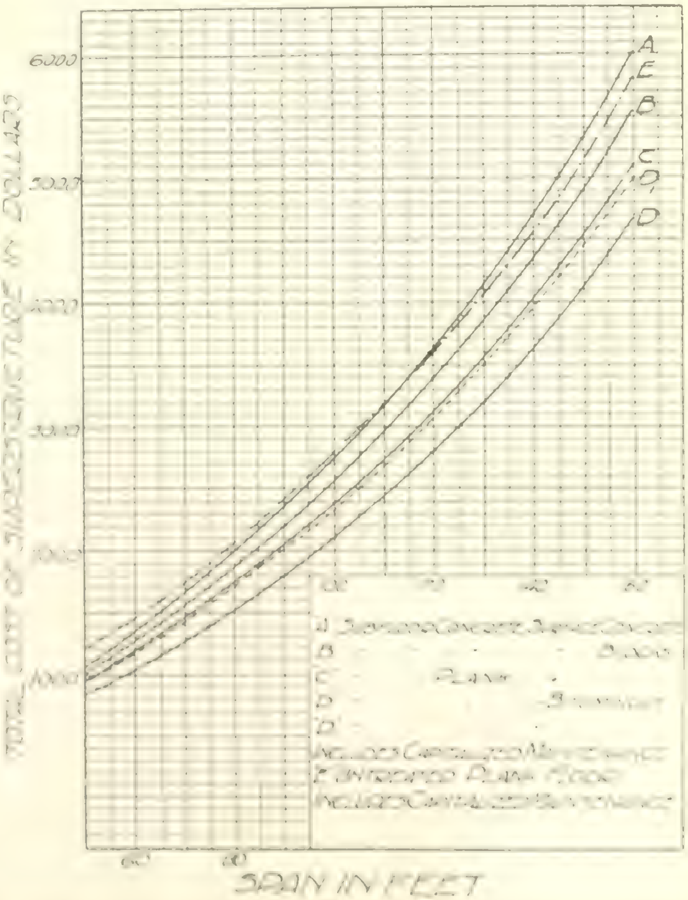
Creosoted plank sub-floor.

The saving in cost for the lighter floors increases with an increase in the unit cost of structural steel in place, and decreases with an increase in the cost of the materials used in such floors.

In reflooring old steel bridges of satisfactory design, a creosoted sub-plank with bituminous wearing surface has been found to give reasonable service. The weight is somewhat greater than that of a plank floor, but the effect of the added weight is probably offset by the reduction of impact, due to the comparatively smooth and wielding surface.

The cost of maintaining the bituminous surface is only about 20 per cent. of that of an ordinary plank floor.

There seems to be no place in the economic design of new highway bridges for floors consisting of a creo-



Fig

soted plank sub-floor with a brick wearing surface, as the life of such a floor could hardly be greater than that of floor C, Fig. 1, while the cost of the complete superstructure would be greater than that represented by curves B and C, Fig. 4.

The floors listed under Class A seem hardly to be justifiable, except for short spans, unless other considerations outweigh first cost.

The Selection of Road Machinery*

By T. R. Agg†

THE wide range of machinery and appliances available for road and pavement construction makes advisable a careful selection for any particular class of work, and yet many types of machinery are so much alike in general design that a selection must be based on a careful study of their operating characteristics. Probably there is no one best type as a general rule. It is not within the scope of this paper to discuss the many kinds and varieties of good, bad and indifferent road building machinery, but it is proposed to discuss a few principles applicable to its selection, operation and maintenance.

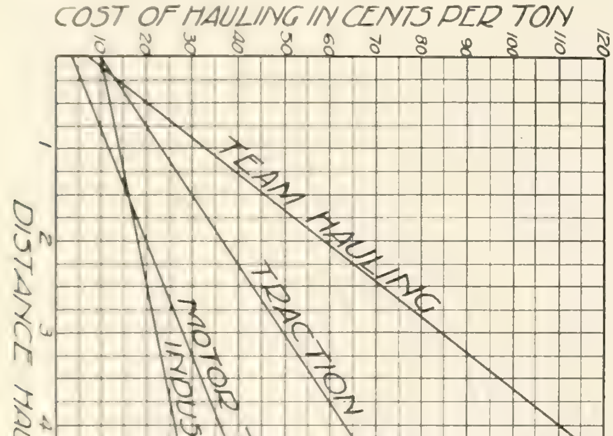


Fig. 1

We find a group of machines available for earth road work, another for macadam construction, and so on through the various classes. These groups overlap to some extent.

Of the machinery offered for earth work certain types, such as the leveller, are for a rather limited kind of work, while others, such as the blade grader and elevating grader, are for more diverse uses. When a selection is to be made for a special work for which only one class of machine is made, one has only to choose the best bargains from the limited offerings of the class. But when machinery is to be chosen for more diverse uses operating characteristics and adaptability must be considered. It will usually be found that the selection may be narrowed down to two or three makes and the final choice will depend upon price and personal preference.

The leveller has already been mentioned as an example of a specialized machine, and the mixer for concrete pavement construction is another. For this work it seems to be agreed that the traction type with boom delivery is the best. Of these, several makes are available and which to select will depend upon the purchaser's opinion as to the value and suitability of individual machines.

On the other hand, the choice for earth road construction will be between the elevating grader and the blade grader, and between traction haulage and team haulage, and between the steam tractor and the gas tractor. Here the purchaser must decide between the classes first of all, and then between individual makes of the class.

This is typical of the machinery available for many classes of road work and the basis for a proper comparison is not easy to state. It is believed, however, that the following factors must be taken into account: (a) purchase price, (b) rate of depreciation, (c) maintenance cost, (d) cost of operation, (e) speed, all of which enter into the cost of doing work with any piece of machinery.

To properly estimate these factors there is at present but incomplete and contradictory cost data available and engineers and contractors can do a great service by giving publicity to any reliable and conclusive cost data that comes into their hands.

Purchase Price.—Some kinds of machinery will save their cost in a comparatively short time and such may unhesitatingly be chosen because the user can readily foretell whether he has enough work ahead to make the investment profitable. Other kinds require a large outlay and must be used with reasonable regularity for a term of years before they will prove profitable. Eventually, if they can be kept busy they will pay out, but before such machinery is purchased there must be some assurance that the necessary work can be secured. It would often be cheaper in the long run to use a machine which operated at higher unit costs, but which could be purchased at a much lower price.

Depreciation.—Depreciation is probably the most difficult factor to estimate, because the carefulness of the operator has such a marked influence on the life of a machine. With most machinery the average life is fairly well established and hence depreciation can easily be estimated. This is a very important cost item and is probably more often placed too low rather than too high.

Maintenance.—The influence of maintenance on unit cost is well understood and needs no especial comment. Probably this item is also more often underestimated than overestimated. It should be borne in mind that maintenance cost really includes not only the charge for making repairs to a machine but also the cost of delay due to the idle time of the machine.

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[*] Paper presented at the Annual Convention of the American Road Builders' Association [illegible] week in Chicago.

[†] Professor of Highway Engineering in the Iowa State College.

When a large gang is working around a machine such as a concrete mixer, any delay on account of the machine is expensive.

Cost of Operation.—The cost of operation for a machine should be taken from the average of many runs under normal conditions and not from exceptional runs made under the most favorable conditions. Quite often this average will be double that which is occasionally obtained when all conditions are favorable. This cost will include the pay of all men needed to run the machine and the cost of all supplies regularly used in its operation.

Speed.—The rapidity with which a machine performs its work is a very important consideration not only from the standpoint of cost per unit of work done but from the impetus it gives to the entire job. This is particularly true in road and pavement construction where favorable weather conditions must be utilized.

Skill Required to Operate.—The skill required to operate a particular machine should be given consideration, because expert operators are not always easily obtained and if a machine requires considerable skill in operation to produce the maximum output, its average may be low due to the difficulty of securing and retaining expert operators. Such machinery should usually be purchased only because of its marked superiority in other respects.

Adaptability.—Adaptability of a machine to various classes of work is an important consideration because it is rarely possible to foretell just where it will be used next, and it is better to use a reasonably efficient machine continuously than it is to use a special and highly efficient machine for a certain kind of work and have it idle a large percentage of the time.

Having estimated as accurately as possible the various factors enumerated as above, preference should be given to the one type showing up the best.

The adoption of certain types of machinery for various classes of road work has been largely a survival of the fittest, although on account of the new types that are continually being marketed, the process of weeding out is going on constantly. For most classes of highway work the preferred types are fairly well known and to enumerate them here would serve no useful purpose.

In rural communities labor is usually scarce, and the contractor in highway construction will find it to his advantage to utilize every machine that will facilitate his work even though it may not in all cases reduce his unit costs. In the long run he will profit because of a greatly increased yardage for his season's output.

Those engaged in constructing roads and pavements have long realized what a large item of cost is incurred in hauling materials and some discussion of the methods available is pertinent to this paper. Many factors involved in determining the cost of hauling are variable for work in different localities but for a given piece of work the amount of each of these can usually be selected with reasonable accuracy, and the economy of various methods thus compared.

The cost of hauling varies with the following factors: (1) length of haul; (2) rate of travel of the outfit used; (3) amount of time lost at cars while loading and at road while unloading; (4) amount of time lost on account of bad roads; (5) capacity of the outfit per trip; (6) cost of operation of the outfit.

Length of Haul.—Length of haul for a given piece of work is, of course, the same no matter what method of hauling is used.

Rate of Travel.—The rate of travel varies somewhat between outfits of the same kind, and yet there is a value that is reasonably near an average for all outfits of a type. For teams two and one-half miles per hour, traction outfits three miles per hour, motor trucks ten miles per hour, and for the industrial railway ten miles per hour may be taken as typical speeds, assuming half the distance is travelled empty and half loaded.

Lost Time.—The amount of time lost at cars depends upon the method of loading the outfit. If hand shovelling is resorted to, the time will be relatively long, but extra units of the outfit may be loaded while the others are on the road. This is advisable for all classes of hauling outfits and is a necessity in traction hauling and with the industrial railway. Bins at the sidings with capacity for a full load for the outfit may be used instead of extra units of equipment and are a necessity when the motor truck is used. For team hauling the loading chute may be employed instead of extra wagons. In any case time lost at the cars is expensive, especially on short hauls, and should be eliminated as far as possible.

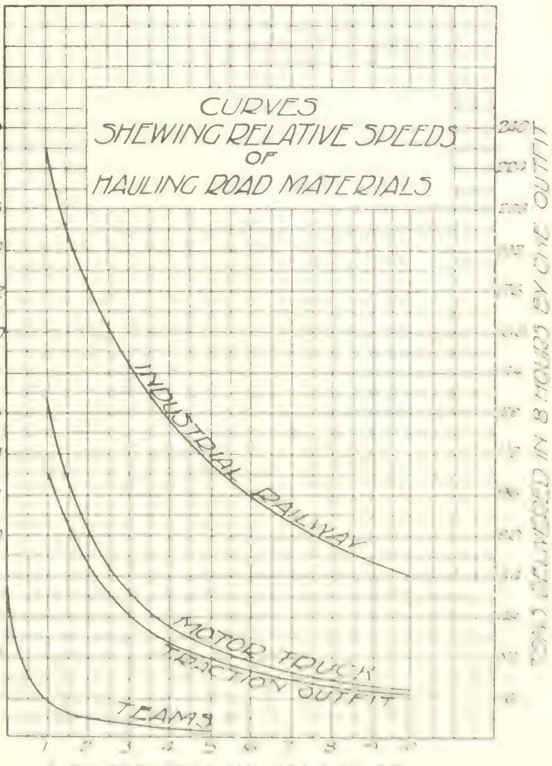

Fig. 2

Records of loss of time in loading and in unloading are exceedingly diverse but the following amounts lost per trip are near enough the average to give comparable results: with team hauling 18 minutes, motor trucks (loaded from bins or hoppers) 6 minutes, traction outfits, 30 minutes, and with the industrial railway, 30 minutes.

Time lost due to the condition of the road cannot be evaluated in a discussion like this because it varies throughout the season, differs with the locality and with the kinds of roads over which the hauling must be done. It is greatest with the traction outfit, is about the same for team and motor truck hauling, and is a negligible factor for the industrial railway.

The capacities of these outfits per trip are also exceedingly diverse and perhaps no particular one is typical, but equipment of the following capacities is in common use:

Wagons for team hauling two tons, motor trucks five tons, traction outfits fifteen tons, industrial railway trains twenty tons.

The cost of operation of each of these outfits will vary with the skill of the superintendent, the character of the operator, the kind of weather encountered, and the nature of the road that is used. Cost of operation should include the following items: interest on investment, depreciation on outfit, maintenance of outfit, fuel, oil and other supplies used and labor cost of operation.

These various items must be evaluated in estimating the cost per hour for operation, and a careful study of the subject has led to the assignment of the following values. If any inequalities exist here it will of course change the entire relation, but the method of comparing costs of hauling as outlined is applicable and that is the principal object of this discussion. Cost of operation per hour for teams $0.50, for motor truck $2.00, for traction outfit $3.00, for industrial railway $4.00.

Knowing the relation that exists between these various factors that enter into cost of hauling, an equation may be written to show the cost per ton which is as follows:—

$$C = \frac{rd}{us} + \frac{Tr}{u}$$

where

$C = $ cost per ton for a length of haul $= \frac{d}{2}$

$d = $ distance in miles travelled per round trip.

$u = $ number of tons hauled per trip.

$s = $ speed of vehicle in miles per hour.

$T = $ time lost loading plus time lost unloading.

$r = $ cost of operation in dollars per hour.

If, in the general expression given above, we insert the values of the various factors for each method of hauling, we get the unit cost of hauling by that method for any length of haul $\frac{d}{2}$. These are as follows:

$C = 0.1\,d + 0.075$, for team hauling.

$C = 0.04\,d + 0.04$, for motor truck hauling.

$C = 0.066\,d + 0.10$, for traction hauling.

$C = 0.02\,d + 0.10$, for industrial railway hauling.

For convenience of comparison the unit costs for various lengths of haul have been computed and the diagrams in Fig. 1 constructed. It is easy to see at a glance the most economical method for any length of haul. If the assumed values of the various factors are in any case inapplicable to a given set of conditions, the proper ones may be selected and similar curves drawn for use in comparing the costs for those conditions.

It is also convenient to know the capacity of these various outfits per working day and the diagrams in Fig. 2 have been drawn to show the amount of material each outfit will deliver per hour and per day when working under the assumed conditions.

The important thing in this discussion is not the relative costs shown by these diagrams but the possibility of reducing to definite data the probable costs for any piece of work, thus obtaining a basis for determining which method to use.

In all of this discussion one factor has of necessity been omitted which is of greater importance than any other, and that is the personality of the superintendent. One man fails to make certain equipment pay out and another succeeds in accomplishing remarkable results with it. Two sets of cost data are obtained, the one showing abnormally high costs, the other showing costs that are exceedingly low. No general discussion can ignore these facts but they cannot be put into data for use in average cases.

Instruction to Engineers

States, municipalities and a few construction companies seek to insure that no engineer in their employ will allow the organization of which he is superintendent to fall below the average in efficiency. To that end instructions regarding the use and capacity of various kinds of machinery and as to methods of organization are furnished. Some of these manuals of instruction are excellent treatises on highway construction. Three phases of the use of machinery are usually presented and these cover the normal requirements of such instruction.

The general organization of the work is first outlined. Ordinarily some one machine or operation is the pace maker for the whole job and when that is true the engineer in charge of construction must build up his whole organization about that machine or operation. The instructions can outline a workable organization, but the live engineer will usually be able to improve upon the details.

The instructions next deal with the capacities of machines, rate of construction that can be attained, and quality of work that should result. Such matter serves admirably as a yard stick by which the engineer may measure his efficiency. Here again, a man's personality will often enable him to do much better than the average set down in the instructions.

And finally the instructions deal with reports, cost data and records of progress that are required. In this respect the instructions will be specific and lay down exact requirements.

Instructions to engineers are not, nor can they be, a series of exact rules that must be followed because no one can foresee all phases of the multitude of detail that enters into the prosecution of construction work, and competent engineers would be hampered by instructions that attempted to prescribe exactly how each machine should be utilized.

Instruction to Operators

In the widespread use of costly machinery there always lies the danger of loss through incompetent operation. Delays due to breakdowns are costly and often avoidable. Here again many states and municipal organizations seek to avoid trouble by furnishing to machine operators complete instructions.

These instructions deal first of all with the operation of the machine and since the work is largely mechanical though skilled, the instructions can say in detail just how the machine is to be handled. Here minute instructions are justifiable and they should include besides suggestions on operations, others on the care of the machine, the making of repairs, methods for adjustments and renewals of working parts.

The matter of personal conduct should also be dealt with in these instructions since the public often obtains its impressions of a department by the conduct of some irresponsible subordinate.

The construction of highways involves the handling of much bulky material, and consideration of efficiency and economy requires that the machinery shall be well adapted to the work for which it is used, that the operation be systematized so that each machine will produce to capacity, that the machinery shall be handled in an intelligent manner so as to have normal life, and that the problem of transportation be studied in all its relations before a system is adopted.

Water-Works Service Pipes

No problem in water-works operation, apparently, is of greater interest to water-works officials generally than the selection of the kind of service pipe and the method of connecting mains and services. Some points brought out in the discussion of these subjects at the November meeting of the New England Water Works Association are given by Engineering News.

Brookline Practice—F. F. Forbes, superintendent of the water-works of Brookline, Mass., cited 40 years' experience with cement-lined wrought-iron pipe with no record of trouble from corrosion on straight services, but about 30 instances of corrosion at the curb cock connections.

His department has always used a lead goose-neck connection at the main to allow for settlement in the service pipe or main, which is always liable to follow disturbance of the street for sub-surface construction. These goose-necks save many leaks, for several instances have been found where the goose-necks had been straightened out by settlement of the pipe yet the connection remained intact.

Service pipes are laid at a depth of 5½ ft. and no trouble is ever experienced with frozen pipes.

Some lead service pipes are used, but difficulty has been found in getting pipe to stand the high pressure used in Brookline.

In getting around subsurface obstructions, it has been found easy to bend cement-lined service pipe to as short as a 10-ft. radius without damage to the cement lining.

The pipe couplings are lined with cement while fastened to one end of a length of pipe, and the cement lining is afterwards dug out of the thread to insert the added length. The F. O. Norton brand of natural (Rosendale) cement is used, as ordinary Portland cement is found to be lacking in elasticity.

The pipe fittings are galvanized-iron. Corrosion of the exterior of the pipe just inside the cellar wall is the commonest source of trouble. In such places and in locations subject to alternate wetting and drying the water department now uses galvanized iron pipe, cement lined.

Marlborough Experience—Geo. A. Stacey, superintendent of the water-works of Marlborough, Mass., said that two cases of lead poisoning through the use of lead pipe for well water, in the early days of the city's water-works, resulted in such a popular prejudice against lead pipe that cement-lined wrought-iron pipe was subsequently adopted for all service connections. Cement-lined iron pipe was used for eight or ten years, but much trouble was experienced by rusting out at joints. Accordingly, about 15 years ago, the water department quietly returned to the use of lead pipe, and it has been used ever since without the least suspicion of lead poisoning.

Holyoke Experience—Patrick Gear, superintendent of water-works, of Holyoke, Mass., stated that ordinary iron service pipes had been in use for 40 years in Holyoke. No goose-necks are now used for connections at mains, owing to the difficulty in cleaning the service pipes. At present, galvanized-iron and lead-lined iron pipe are being used.

CONCLUSIONS

Instances were cited of long life in galvanized-iron service pipe, but these were exceptions rather than the rule.

An objection was raised to any kind of iron pipe because of the expansion and contraction, which leads to breaks at the curb cock; but this objection is largely overcome by the use of lead goose-neck connections. On the other hand, the objection to a goose-neck connection is the impossibility of cleaning the entire service from house to main. This has led to taking out all goosenecks in Holyoke, wherever new services are placed or renewals are made.

There is a need and a market for some kind of cheap expansion joint for use at curb cock connections, and a need for an effective small pipe-cleaning apparatus.

Difficulties with cement-lined service pipe are chiefly corrosion at joints and want of elasticity. The couplings must be cement-lined, or in some instances rubberoid and tar have been used successfully for lining. Sometimes lead couplings are used. Cement-lined pipe must always be sawed in two and not cut in a pipe-cutting machine, which destroys the lining in the vicinity of the cut.

Lead service pipe is the prime favorite of water-works men generally because of its freedom from corrosion, expansion and contraction troubles, and the ease with which it is bent and cut to fit any location.

Lead pipe should never be used, of course, where there is any chance of lead poisoning, but this is believed to be rare. Robert S. Weston, consulting engineer, of Boston, Mass., pointed out the extreme difficulty in determining by laboratory tests certainty as to whether water would or would not permanently affect lead pipe. Acid swamp waters are particularly dangerous.

The only real grade in many cases is experience; if lead pipe becomes coated on the interior, it is probably safe to use, but any lead pipe which retains a bright interior surface after extended use is almost sure proof that the water conducted through it has dissolved lead and is dangerous. Much popular prejudice against lead pipe is founded on sentiment rather than real reason, was the general opinion.

In many cities public-service corporations place their sub-surface structures in any part of the street they see fit, and as the water main is usually near the middle of the street, the result has often been that these public-service structures have completely blanketed the water main, making straight service pipes impossible. This is a condition to be met by a better organization of city departments and by granting more authority to city officials over public-service corporation construction work.

General Principles of Snow Removal

City engineers and other municipal officials may find some interest in the following general conclusions of a special committee appointed to submit a report at a recent conference of street-cleaning officials at Philadelphia. The officials in question represented sixteen cities in Massachusetts, Oregon, and the District of Columbia.

1. The plan of organization and the system to be employed should be worked out in advance of the snow season. The preliminary work should involve: (a) plan of co-operation of all branches of the municipal government; (b) the formation of a skeleton organization composed of all the available city forces, such as engineers, inspectors, time-keepers, laborers and teams; (c) the division of the city into zones and the determination of a definite method of work for each zone. The various members of the organization should be assigned to these zones and the responsible officials familiarized with the duties expected of them.

The character of work to be performed in the different zones may consist of merely the regulation of opening cross-walks and gutters and otherwise generally assisting pedestrian traffic and the run-off of the snow, or it may consist in the complete removal of the snow from the streets. Owing to the general increase in motor traffic and the concentration of business in definite office districts and to the general public demand for increased urban facilities, the present tendency is to increase the scope of the work involving the complete removal of snow from all main thoroughfares and business streets.

2. The work of removal should commence as soon as the snow has covered the pavements and the indications pointing to the storm continuing the operations should be carried on continuously. This as a principle is successfully followed by street railways in the removal of snow from their track space and by some cities.

3. The carrying capacity of the sewer system should be utilized as far as possible to get the snow away from the streets.

The use of the sewers which reduces both the haul and handling to a minimum involves two operations: namely, getting the material to the catch basins or manholes, and then putting the material into the sewers. The first operation can best be done by loading into wagons or trucks and hauling to suitable manholes or by the use of scrapers or graders. The problem of getting the material into the manholes in the least time and with the least interference with traffic opens up a field for consideration of the question of special forms and special locations of manholes designed to be used solely for this purpose.

The method of flushing the snow with fire hose into catch basins may have a limited application, but it is too unreliable to have any general value, as it depends on weather conditions.

4. When practicable, where there is only a small area to be cleaned, the work should be performed directly by the municipality by day labor. This method of operation is the most flexible and the most easily administered and it obviates the necessity of measurements and checking involved under the contract system. The work can also be performed by day labor in large areas by adopting the following method: The department to advertise and go out into the open market and hire teams to haul the snow for so much per yard, the price to be determined on by the department and to represent a fair estimate of the cost of the work and a fair profit. This, of course, would throw the work open to anyone owning one team, or a hundred or a thousand or more teams, depending upon the amount of work to be performed, and would not leave the department dependent upon any one or more contractors. In this method, as well as when the work must be performed by contract system, a method of measurement as simple and accurate as possible should be used. The practicability of having work done by the municipality will depend among other things on the immediate availability of an appropriation. It is essential for the proper conduct of the work whether by day labor or contract that appropriation for snow removal should be made in advance of necessity for the work.

5. Co-operation should be sought with the traction companies and use made of adjustable plows and sweepers to open roadways adjacent to street railway tracks at the time that the work of clearing the tracks is being carried on.

6. Effort should be made to obtain the co-operation of the public and to instruct the householders in the method of the removal of snow from private premises in such a way as to least impede the city's work. Where sidewalks are of greater width than would be necessary to handle the reduced volume of pedestrian traffic, which may be expected after a heavy snow, the snow instead of being entirely cleared from the sidewalk and piled in the roadway should be left on the sidewalk near the curb line to be removed later by the city when opportunity presents itself.

7. The police force of the city should co-operate with the street cleaning force and the services of patrolmen as inspectors should be utilized as far as possible. The police in particular should give attention to the enforcement of regulations governing the removal of snow from the sidewalks or from a portion thereof.

Tunnel-Boring Records Broken

World's records for tunnel-boring have been established by Messrs. Foley Bros., Welch & Stewart, contractors on the C. P. R. Rogers Pass tunnel scheme. Last month, states Mr. A. C. Dennis, superintendent of construction for the contractors, 817 feet of the "pioneer" heading—the preliminary shaft running parallel to the main passage, from which operations are directed at several points—was excavated. The American record for a month's tunnel boring was 810 feet, and this feat was accomplished in 31 days, while there were only 30 days last month. The maximum amount of excavation on a tunnel heading for a day was formerly 36 feet, this projection being accomplished on the Simplon tunnel through the Alps. This record was eclipsed one day last month on the tunnel through the Selkirks, when 37 feet was excavated. The world's record was beaten also for a week, 220 feet of rock being bored.

As a result of the rapid progress now being made with the tunnelling operations, the contractors are now confident that they will put the Rogers Pass tunnel through several months earlier than their contract with the Canadian Pacific calls for. The five-mile, double-tracked passage through the base of Mount Macdonald is to be ready, according to the terms of the firm's agreement, by the end of 1916. At the present rate of projection it is estimated that the tunnel will be completed in the summer of 1916.

There remains 16,000 feet of the "pioneer" shaft yet to be driven, 10,640 feet having already been bored.

At the west end of construction, 317 feet of the preliminary shaft, and 640 feet of the main passage was excavated last month. From the eastern portal 527 feet of the former and 588 feet of the latter was projected.

Although the work has been well advanced the hardest part of the actual boring has yet to be done. Mr. Dennis states that the next two miles through the heart of the mountain will have to be dug out of a particularly hard kind of rock.

Characteristics of Materials

By E. B. Tilt†

SOME time ago it occurred to us that a popular description of the physical characteristics of some of the materials used in the mechanical department of a railway would prove interesting and might lead to a profitable discussion. Not all of us could tell off-hand how to distinguish a piece of iron from a similarly-shaped piece of mild steel, or where we shauld use bronze instead of white metal, or why a piece of high speed steel can be run at a red heat and retain its usefulness. These and many other questions are not of the same importance to us all, but the explanations are interesting. As my experience has been mainly with the materials used in the construction of rolling stock I shall not discuss those required by the Engineering Department, and which include rails, ties, structural steel, masonry, and so on. I shall not discuss devices either, but confine myself strictly to materials and their attributes.

The principal groups of materials brought for railway shops, nearly in their order of value are: (1) iron and steel products; (2) lumber; (3) brasses, bronzes and other alloys; (4) paints; (5) rubber products.

Iron and steel products cover a very large percentage of the cost and construction of an engine or a car and these may be further subdivided into (1) STEEL (a) rolled or forged, (b) cast; (2) IRON (a) puddled, (b) cast, (c) malleable.

Consider a locomotive for a moment. The spring plates, firebox and boiler plates, tyres and tubes are made of rolled steel; of forged steel the axles, side rods and crank pins; of cast steel the frames, frame braces and cross heads; of puddled iron the engine bolts and staybolts; of cast iron the stack, bell stand and small fittings; the journal boxes and a few small fittings of malleable iron. If we run over in our mind's eye the materials in a modern steel frame freight car we have cast iron wheels, forged steel axles, rolled steel sills and frames and springs, cast steel couplers and pedestals, malleable iron journal boxes, door locks and stops and minor fittings.

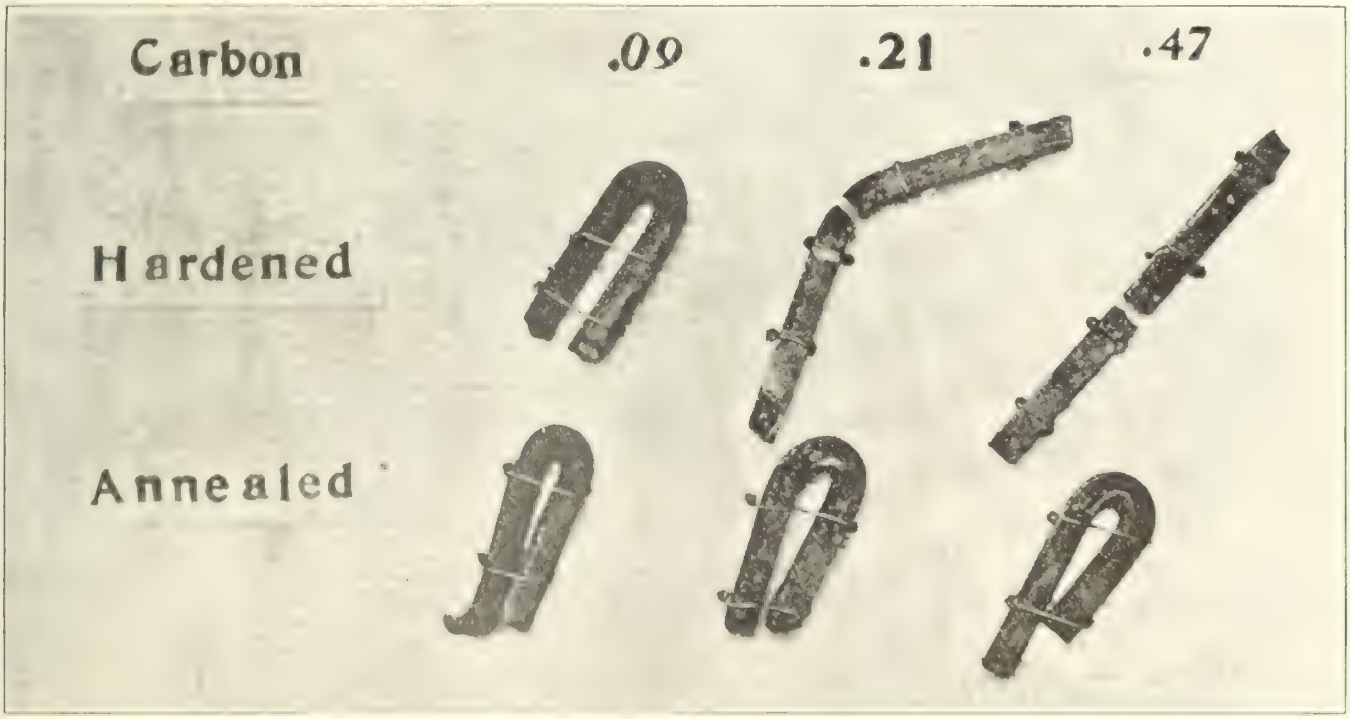

Fig. 1.—An illustration of the effect of various amounts of Carbon on Steel

A reasonable question is why are so many different qualities of the same material used, for all iron and steel is originally derived from pig iron made from iron ore. Broadly speaking, cast iron is used in intricate shapes, where lightness and tensile strength are not required. Where more delicacy and intricacy in design are evident and weight or thickness is a factor, malleable iron is used. Where even greater strength is required cast steel is used. Rolled steel and forged steel differ chiefly in the final shaping operation. For example, a tyre is rolled on a special type rolling mill, while an axle is forged or shaped under a hammer or press. Wrought iron is used principally in merchant bar, where advantage can be taken of the so-called fibre or toughness of the iron.

It may be well here to mention a very important

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*From a paper presented at a recent meeting of the Canadian Railway Club at Montreal.

†Engineer of Tests, Canadian Pacific Railway.

factor as affecting the value of steel for any use, and that is its carbon content. In order to simplify the consideration of this important element in its effect on iron, we shall overlook the effect of manganese a metal somewhat similar to pure iron; of phosphorous, most commonly seen as a constituent of the striking head of matches; of sulphur, recognized by its yellow color and commonly known as brimstone; of silicon and traces of other metals, all of which form compounds either with each other or with iron which affect the characteristics of the steel.

All are familiar with the effect of carbon in carbon tool steel and its results in making the tool hard when the steel is quenched from redness in some cooling medium. To show how various amounts of carbon affect steel Fig. 1 has been included.

This result is, of course, produced by heating the samples to redness and quenching in water and testing one piece in the hardened condition and a similar piece after annealing. It will be seen that the piece with .09 per cent. carbon, say one-tenth of one per cent., bends through 180 deg., but that with .21 per cent., say two-tenths of one per cent. of carbon, the hardened piece bent through only about 30 deg. before breaking and the piece with .47 per cent. of carbon, say half of one per cent., broke without bending at all. Now note that all the pieces bend through 180 deg. without breaking if they are annealed. This shows the hardening effect of carbon when the effect is produced by suddenly cooling the steel or the lack of effect if means are taken to prevent the carbon performing the functions of which it is capable.

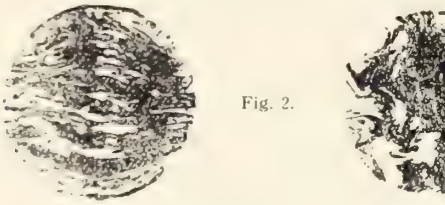


Fig. 2.

No. 1. iron. Staybolt iron.

Here, then, is suggested the difference between low carbon boiler plate, which must be punched and bent, and low carbon tubes which must be beaded, all of which are soft steel as compared with tyres which are hard steel and must withstand wear. This hardness affects the tensile strength of the steel as well as its capacity to stretch or have "elongation," as it is commonly called.

On a locomotive, steels are used varying from one-tenth to seven-tenths of carbon, as follows:

.10 to .20 Carbon,
.2 to .3% "
.4 to .5% "
.4 to .5% "
.6 to .7% "
.7 to .8% "
1.0 to 1.10% "

Boiler, firebox plate and tubes.
Bolts for side rods.
Side and main rods, piston rods and axles.
Knuckle pins for couplers which are hardened in oil.
Cross head keys and tyres.
Spring steel which is specially hardened and tempered.

The reason for low carbon in plates and tubes, giving what is termed a mild steel, is to have a soft, easily working ductile material.

Bolts with .25 carbon cut with a cleaner thread than those with less carbon and have a greater tensile strength.

Axles, side and main rods, piston rods and crank pins with .45 per cent. carbon have fair hardness for wear and have good strength.

Knuckle pins, which are oil toughened, have a high shearing value and good wearing qualities.

Cross head keys have a high shearing value, tyres are hard for wearing quality.

Springs which are hardened and tempered have a high tensile strength and resistance to fatigue.

Here your attention is called to an interesting attribute which all the steels and wrought irons have in common, and that is, that if you took the same cross section and same length of bar of each and put the same load on each, the stretch would be the same, provided the elastic limit were not exceeded. The "elastic limit" is that limit which must not be exceeded if the material stressed is to return to its original shape. Steels which have not been hardened have the elastic limit one-half of the ultimate strength. For example—boiler plate, wth an ultimate strength of 55,000 lbs. per square inch, has an elastic limit of about 27,500 lbs.; steels which have been hardened have the elastic limit about two-thirds of the ultimate strength. This explains then why making a coil spring harder does not make it stiffer, though it is true that it may bend further and come back to its original shape, as compared with one not so hard.

A widely held idea is that wrought iron is fibrous in structure, while steel is crystalline, and for this reason staybolts which are subject to unknown stresses withstand better if made of iron. Fig. 2 shows the ends of bars of different irons which have been etched to show their structure.

Iron is made by welding many bars together and then rolling them out, and the difference in the amount of work put on these two irons is easily seen. Fig. 3 shows a fibrous fracture of iron and a crystalline fracture of the same iron, both depending on whether the nicking extends all around and the bar is sharply broken or not. For comparison is shown a fracture of steel of the typical crystalline kind, together with a fibrous, or perhaps more properly called, laminated steel fracture of a spring plate.

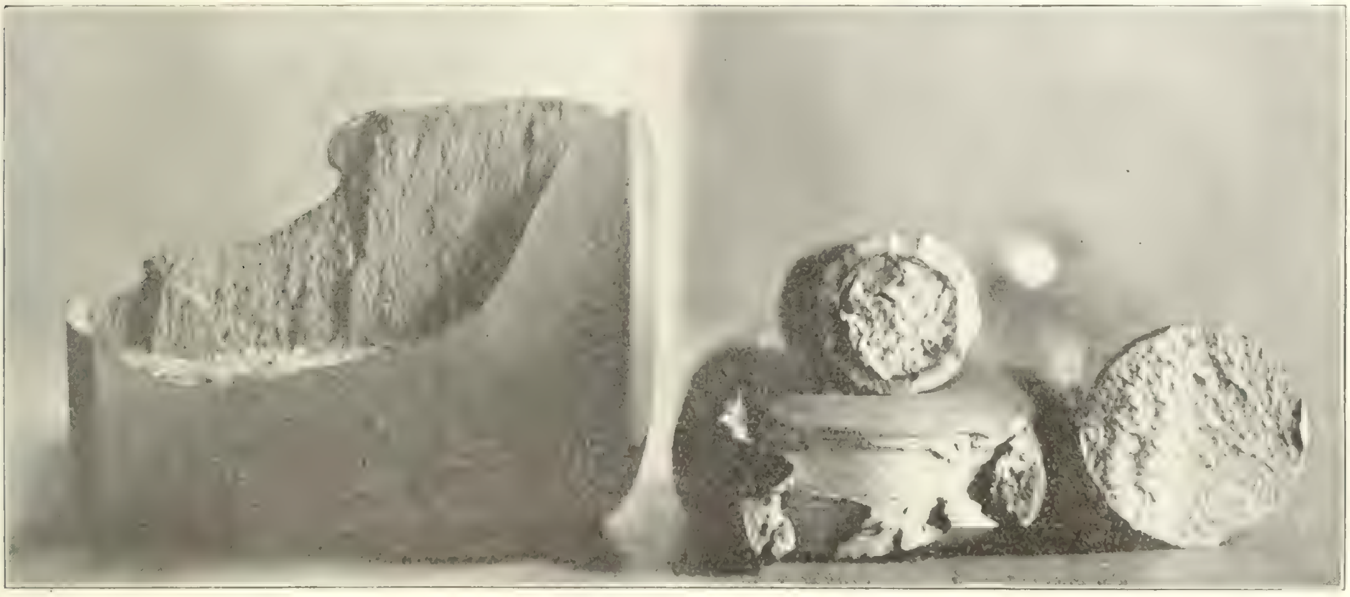
Much is heard about fatigue of metals. Fig. 4 shows a failure of that type. This is a crank pin which in service is pulled and pushed on two sides only. This is a fracture in detail because failure has taken place in detail or bit by bit. This type of fracture is often mistaken for a flaw in the material. Fractures in detail are common on axles or on any material which is alternately put into tension and compression many millions of times. Failures in detail are caused by overloading, by using too little material or allowing it to be used too long.

Again, material is said to become crystalline due to its use or abuse, which in turn causes failure. This belief in the growth of crystals is probably due to failures of iron, whose fracture showed to be crystalline, whereas a fibrous fracture would ordinarily be expected. In my opinion there is no change in the size of the crystals when temperature is not a factor in the use of material, and that the crystalline face on the fracture is due to the method in which failure was made—that is, the path of fracture has been altered as compared with what it would have been had the metal been fractured new without any use.

There are failures because of an inherent defect in the steel due to a pipe or cavity in the original ingot and there are a number of other defects, such as blow holes and segregations, which may occur in rolled steel. It is not intended, however, to dwell upon poor material as it is a very small proportion of the total used.

Cast steel is poured into a mold very much in the same manner as cast iron and is consequently used for intricate shapes where a stronger metal than malleable iron is required. In order to relieve the shrinkage strains due to casting and to increase the ductility, steel castings are annealed.

Malleable iron is now confined to small castings, thin in section and complicated in shape. Because of the fusibility of malleable iron at a low temperature, no greater moulding difficulties are found than with cast iron. Malleable castings when poured are chilled as white as the tread of a cast iron wheel and a long annealing is necessary to give to the iron its malleability and ductility. This malleability is due to the change in the condition of the carbon in the iron.


Spring plate. Iron. Steel.

Cast iron is used for many purposes yet and the largest castings are locomotive cylinders and car wheels, very few driving wheel centres being made of cast iron now. Cast iron should not be used where it will be in tension, unless these stresses are very low.

There are three principal grades of cast iron for railway use, the softest and weakest being known as machinery grade and comprising those castings which machine most readily; cylinder metal is stronger; and wheel metal is used exclusively for cast iron wheels. The chief characteristic of the last-named is that the iron must be capable of being chilled to form the tread. The interesting thing about these different grades of iron is that as in the case of the grades of steel already enumerated it is the carbon which is responsible for the difference in the irons. The total amount of carbon does not vary, but its condition does. In steel we have all the carbon in what is termed in the laboratory as "combined"—that is, it has combined with the iron to form a compound. In cast iron the carbon is in two conditions, either as graphite showing as black flakes or small black spots, or as "combined." The total carbon will be in the neighborhood of three and one-half per cent., but the combined carbon will vary from half of one per cent. in machine iron to one per cent. in cylinder iron, and to all "combined" in the white or chilled portion of a car wheel. The difference in the test bars obtained from these different irons is all due to the difference in the state or condition of the carbon.

Puddled or wrought iron is so familiar to all that it will suffice to say that while steel has taken many of the places previously filled by iron, yet the eminent suitability of iron for such work as stay-bolts and pins to be case-hardened has resulted in its being used for these and many other purposes. In addition to making a tensile test to determine the strength and ductility of iron, an etched section of the iron is made. This gives additional information as to how well worked the iron is. A test which is being used to distinguish between good and inferior irons is the so-called vibration test. In this test a special test piece is alternately put in compression and tension until failure takes place with a fracture in detail, as previously described in the case of the steel crank pin. Unfortunately, this test is not always conclusive as differences in testing give a greater difference of results than the differences in the material.

It is more difficult to tell the difference between iron and steel than the average person imagines, but shearing will very often tell the story, the iron being softer and shearing more readily. When this will not tell, etching will distinguish. Chemically, there is usually much difference, for we can compare the two thus:

	Carbon	Sulphur	Phosphorus	Manganese
Iron	.05 to .15	.02 to .07	.075 to .20	Trace to .20
Steel	.10 to 1.50	do	.02 to .10	.20 to .80

The greatest difference usually is in the manganese.

A very noticeable difference between mild steel and iron is the poor thread which cuts on mild steel, the metal dragging, while in iron a clean thread is readily cut. Steel makers, in order to make steel that will thread well, purposely leave the sulphur high and the phosphorous too, and much hexagonal cold drawn steel which threads so well is very poor material. So, too, in working. Hot steel is not formed as easily as iron and it is harder on both machines and dies to work steel than it is iron. Most of the common steel pipe is made from Bessemer steel, which is high in phosphorus, because this steel welds very readily and threads well.

It is often desirable to identify the variety of steel which may be under consideration, to know whether it has been made by the crucible process, the Bessemer process, the acid or basic open hearth process. At the present time the amount of steel made in electric furnaces is relatively small. Expensive steels only are made by the crucible method, say steel costing from 6 cents a pound up, so that price generally determines the use of crucible steel. The Bessemer steel is generally distinguished from the open hearth steel by its higher phosphorous content, 0.7 per cent. to 1 per cent., and its high manganese. It is very hard to distinguish between acid and basic open hearth and its source will often have to furnish the clue. Basic open hearth is usually lower in phosphorous and sulphur than acid open hearth, because it can be so made. but otherwise there is no way of readily telling which one has, either by physical tests or the chemical analysis. Usually it does not make much difference, though engineers will be found with preference for acid open hearth because of the initially better stock, from a chemical viewpoint, that is necessary to make it.

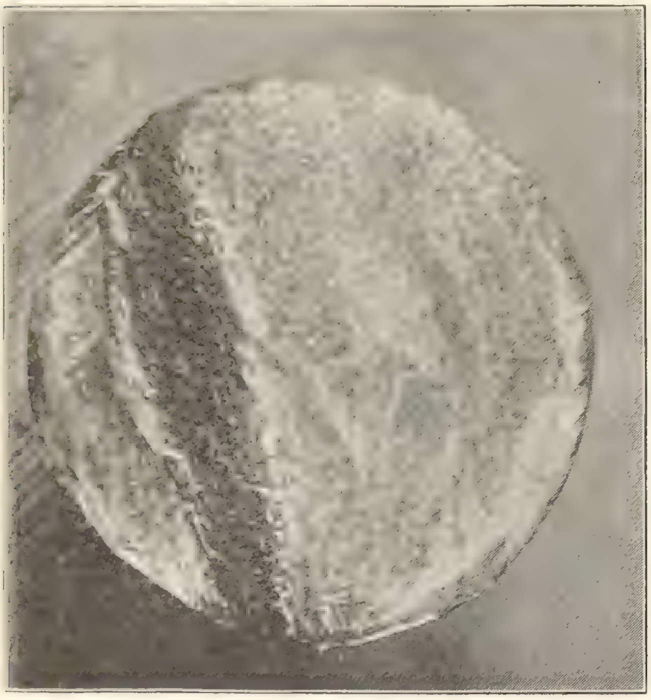


Fig. 4.—Illustrating a failure of the fatigue type.

In addition to the common steels, a number of alloy steels are used. The best known now are vanadium steels. They may be in any form that steel is supplied, and it will suffice to say that vanadium makes for soundness, and that these steels are heat treated. Where a steel is to be specially treated or "heat-treated," as it is termed, then chromium is also added, the chromium making the steel more susceptible to the effect of quenching. Vanadium steel is commonly used as castings in frames, with chromium for axles, rods, tyres, and springs, and it has been used in cast iron for cylinders. Manganese steel is most commonly used where much wear is encountered. Rubbing blocks on locomotives and knuckles of couplers are the principal uses. It takes from .12 per cent. to .14 per cent. of manganese in the casting, which is afterwards quenched to give the qualities desired. High silicon and manganese steel have been used for spring steel. Nickel and nickel chrome steels have not attained any great use yet in locomotive and car building.

Alloy steels are much used for cutting tools and we have the original high speed steels with chromium and tungsten to give the wonderful cutting qualities. Then the addition of vanadium improved these steels and gave a superior class of high speed steels. Latterly Cobalt has been added. This made an improvement, so that we have now the doubly superior steels. No doubt this will give a continued improvement, but it is expected that the English language will break down in attempting to supply adjectives to adequately express the quality, so we shall be reduced to using a letter, such as is supplied to describe the amount of work done on iron. The custom was to designate as B, BB, or BBB, in referring to the number of times that the wrought iron was worked, and this method has been so popular that the general public is now worked into accepting steel chain described as B, BB, and BBB.

The self-hardening tool steels depend largely upon tungsten for their properties. In high speed steels, as in carbon steels for cutting tools, it is our old friend carbon that gives the hardness forming the carbide of tungsten and of chromium, which remains hard at a red heat. The carbide of iron is soft at a red heat, hence high speed steels may be run at a red heat, while carbon steels must be run at a low temperature.

The bronzes, brasses, and white metals are a small but interesting group, and if we think that we know less about them than we do about iron and steel it is perhaps because the latter have received more study and attention. We do not consider a yellow or red metal as any more complex than cast iron, yet given the analysis of a piece of cast iron and some little history, we can fairly well tell its attributes.

Bronzes may be described as copper base metals with up to .10 per cent. of tin and some smaller amounts of lead and zinc, while brasses are a copper base with additions of zinc up to one-third the total weight. The bronzes are used chiefly for bearing metals and steam metals, while the brasses are for decoration. About a railway shop the bronze-bearing metals are usually known as "brasses," which is the old name for any mixture containing copper, but we consider bronzes the better term. Railway bronzes and brasses may vary somewhat on account of the melting of the return scrap, and a consistent effort must be made to keep them up to a given formula. Bronzes and brasses both cast well, and in addition to castings considerable brass in sheet form and pipes is used. The chemical analyses are the checks on the quality of these materials and indicate reasonably well the characteristics of the metals. In bronzes a reasonable strength is needed, and, if possible, total absence of porous or hard spots. In brasses color and soundness are the main considerations. An addition to this class of metals in the last few years is plastic bronze, which is a copper metal containing as much as .35 per cent. of lead. This is a satisfactory metal for bearing purposes and is reasonably cheap.

With the exception of locomotive rod, and driving box bronzes the other bronze bearings are lined with white metal. The white metal is lead with antimony, thirteen per cent. or less, and tin from two to six per cent. The antimony and tin are added to make the lead hard. Here it is as well to explain that lead is often termed a frictionless metal, but this is certainly a misnomer. There is no metal which produces more friction than lead does when used alone, but fortunately it is cheaply hardened by antimony and then becomes of greater value. The value of lead mixtures is the ease with which they change their shape to conform to any alteration in the relative position of the journal and the bearing; consequently there is always present a large bearing area. Theoretically, the lubricating material—oil or grease, forms a film between the bearing and the journal. The advantage of a metal which can adapt itself easily to keep this oil film or wedge unbroken and of greatest area must be a valuable bearing metal.

White metals, with tin as the principal constituent, have only a limited use in railway work and are used where the duty is exceptionally severe, either with excessive pressures or high temperatures, as for metallic packings. White bearing metals with a high content of zinc are not commonly used as far as we know. As with bronzes, chemical analysis is the principal way of checking up the quality of the white metals.

Rubber Products

The rubber products used by a railway are comparatively small in value but are of much interest. Hose for air, steam and water are the most important, and are now being purchased on specification basis with satisfactory results. As in every other line of industry, the use of scrap must be considered. With the advent of increasing amounts of rubber grown on plantations, the "Fine Para" rubber from the upper reaches of the mysterious Amazon River is forming a smaller part of rubber products than formerly. In hose we look for the cotton duck to give the strength and permit of sufficient flexibility, while the rubber protects the duck and makes the hose air, water, or steam tight. As yet, physical tests, including stretching and recovery, and the strength tests are the principal ones to gauge the quality of the rubber. The chemical analysis of rubber is more widely done now that standard methods are promulgated by the chemical societies and a reasonably accurate measure of the constituents of any rubber is now readily made and the amount of new and old rubber determined.

Physical tests on the strength of the duck are made also, so that the physical and chemical tests, together with the knowledge of the physical construction, permit one to make a reasonably good judgment of the service which may be expected from any sample of hose.

The problems of the rubber hose maker are varied, for it can be seen that with rubber compounds and cotton duck he must provide steam hose which must be flexible when used at a temperature of 250 deg. F. or more, while with the same material air brake hose must be flexible at 25 deg. below zero. That this is successfully done is an indication of the skill of the rubber manufacturer.

Paints

Paints form one of the interesting groups of materials. Often the paint manufacturer and the chemist are not in agreement as to what constitutes the best paint for any particular job. There are good paints and plenty of them, but there are poor paints and perhaps even more of them. Paint-making has not yet emerged from the stage of shop formulae and trade secrets. Until such time as paint-making is as open to the engineering world as the iron and steel industry, or as the rubber industry is becoming, there will always be considerable disagreement and dissatisfaction. After all is said, service is what is desired in paint as in everything else that a railway uses. The great difficulty is to agree upon what constitutes satisfactory service.

The present most satisfactory way to buy paints is to have a color card, specify the consistency of the paint desired and leave the rest to the paint manufacturer. In specifying any composition one is usually opening up a fruitless discussion. Linseed oil is still the most satisfactory paint oil. While other oils are being used and with success, linseed oil has not been displaced. Within the last few years there has been much good literature published in connection with paints and much testing work has been done jointly by paint manufacturers' associations and engineering societies. Progress is being made, and the final result is not as hopeless as these remarks on paints would lead one to believe.

Lumber and timber, while forming an important material, is not on a written specification basis like many other materials. This is brought on grades, men skilled by experience in the working up of lumber judging as to the suitability and quality of the lumber shipped. Specifications are used and merchant lumber associations have definitions of grades and imperfections. The inspection of lumber will probably remain in the hands of the men who make its production and use their life's work.

In drawing up specifications, the characteristics of materials are described or exhibited by the tests, but sometimes a specification is criticised in that the tests asked for are not those which show the suitability of the material for the use to which it is to be put. For example, the quenching of a piece of boiler plate or boiler tube at a red heat in water and the requirement of subsequent bending without cracking is not anything like what the material is subjected to in use. But this test is a check on the carbon, for low carbon material is desired, and this method of checking the carbon content is quicker even than a laboratory analysis and quite as satisfactory.

An enumeration of the characteristics of materials is not the only thing necessary to ensure good material and the manufacturer's assistance in giving "full measure," so to speak, in meeting the requirements, together with the manufacturing skill of his organization, will ensure a generally better material than where an effort to just meet or beat the specifications is aimed at.

No claims of originality are made for the information contained in this paper, and it is only desired to treat in a popular way some of the characteristics of the more important materials. Much will have been done if you have been interested in a subject generally considered "dry," and if it has stimulated your interest in these things nothing more is desired.

Asphalt paving on a plank base is being used successfully in King County, Washington, particularly for increasing the service that may be expected from roadways supported on wooden trestles. An untreated planked trestle in the vicinity of Seattle has worn so rapidly that after about eighteen months of service it has become rough, and the automobile traffic, in particular, avoids it in favor of other routes, although the wear is not yet sufficient to warrant renewal. A 2-in. asphalt wearing surface on a substantial 5-inch plank trestle flooring has been in service for seven years on one of Seattle's main automobile suburban routes, and only moderate patching has been required. The longest service may be secured, it is said, by applying the asphalt when the plank is thoroughly dry, and if this is done the roadway should last, assuming good workmanship, until dry rot destroys the plank.

Modern Practice in Refuse Disposal*

An Outline of Satisfactory Methods Adopted in England and France — Vehicles in Use — Sorting the Refuse — Systems of Disposal

By Prof. E. R Matthews, A.M. Inst. C.E.†

IT is now the custom in most coast towns for the refuse to be collected during the summer months at night, the carts leaving the depot about 11 p.m. and returning about 7 a.m., and this method should certainly be adopted in all health resorts. The disadvantage of this plan, of course, is that the noise of the carts as they rumble through the streets at night is disturbing, but the advantage of not having them in the streets during the day quite outweighs this disadvantage.

In many towns the collection of the house refuse is let to a contractor, a method which I entirely disapprove, for the corporation can carry out this work more efficiently, and the fact that in some towns where the work was previously let to a contractor the corporation now do the work endorses my view. Not only so, but contractors, when their term for the removal of the contract expires, frequently put their price up very considerably, and that means usually that the work is let to a new contractor who knows nothing of the nature of the work.

In some parts of the country a good deal of the refuse is saleable. Mineral-water bottles, for example, can be sold; tins, if crushed, and put on rail, are bought; paper and cardboard, glass and crockery in some districts have a small value. It is never advisable for rags to be picked out and sold, for these are likely to convey infection.

It has been suggested that in laying out a new city each house should be connected up to a suction main, which would lead to the destructor, and that house refuse should be thrown into a hopper in the kitchen, which would be connected with the main; the refuse would thus be drawn by suction to its destination. Theoretically this is admirable, but many difficulties present themselves in practice.

In some towns it is the practice for the man who collects the refuse to bring an empty bin and take away the full one. This is an advantage, for it obviates the nuisance of the refuse being blown about as it is being tipped into the cart or wagon.

Vehicles Usually Employed

Ash Carts.—The old-fashioned ash cart is still in use in many towns. This is usually fitted with a canvas cover, which is so arranged that it can be drawn over the piled-up refuse, and lashed down by means of cords. The disadvantage of this method is that while the cart is being loaded the refuse frequently blows off and litters the street, and in a very heavy wind it is almost impossible to prevent this. Carts of this type should certainly be fitted with indiarubber where the tail-board is placed, and it is better that the tail-board should drop into position vertically in a grooved frame rather than that it should be hinged.

Covered Carts.—Instead of the canvas cover, ash carts are now made with a permanent cover, which may be raised or lowered as required, and this is a great improvement on the open cart with the canvas cover.

Covered Vans.—The Corporation of Leamington Spa and many other corporations have adopted the covered van in place of the canvas-covered ash cart, and these are admirable where the roads are fairly level, for they are capable of conveying about 3 tons of refuse. In a hilly district two horses would be required, and therefore it is not economical under those conditions to adopt the covered van.

Motor Vehicles.—These are in use in one or two towns in this country for the purpose of conveying the refuse to the destructor, and the power is usually derived from the burning of the refuse. In France this method has been largely adopted. The Municipality of Paris has a large number of motor vehicles engaged in this work. At Havre, Nancy, and other French towns these vehicles are in use. "The Fram" vehicle seems to have met with most favour on the Continent. We in this country have not adopted this method of conveying refuse to the destructor unless it be in an isolated case, but I have no doubt that we shall do so in the near future, although up to the present I have not been satisfied that there is any saving in cost over the ordinary horse-drawn vehicle, chiefly on account of the time the vehicle must necessarily have to stand idle in the street. For other municipal purposes it is admirable.

Unsatisfactory Methods of Disposal

Every local authority should consider which is the best and cheapest method of disposing of their town's refuse. In many towns this contains a large percentage of nightsoil, in others it contains none. Here and there throughout the country one finds the town's refuse being tipped in old quarries and disused brickfields. Such methods of disposal are far from satisfactory, for there is a danger of contaminating the water supply, and if not, to have a nuisance of this kind in the district must be injurious. In one of our Midland towns the household refuse is carted to the depot, where it is drawn up an inclined plane on to a strong horizontal screen of 2-in. mesh fixed at a height of 10 ft. above the ground level. On one side of the screen a furnace has been constructed, and into this paper, rags, etc., are thrown and destroyed. Two labourers working on the screen salve bottles and old tins, the remainder of the refuse dropping through the screen. This is received on an inclined riddle of ¾-in. mesh, and the larger ash is deposited outside at the ground level, and sold to market gardeners for use as fuel in rhubarb-forcing sheds. The finer ash which falls through the riddle is deposited in a pit beneath. Tanks are constructed in the yard, and this ash with the addition of the nightsoil is converted into manure, which has a ready sale to farmers in the district.

In some places it has been the custom for the refuse to be taken direct to the farmers in the district, but it is only during certain periods of the year that this refuse is of any use to the farmer, and so, during many months of the year it has to be stored until the farmer is prepared to receive it.

The refuse in other towns is taken by rail direct to the suburbs, where it is used by farmers, market gardeners, and others. The loading and unloading of this is often a great nuisance.

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* From a lecture delivered recently at University College.

† Chadwick Professor of Municipal Engineering in the University of London.

In several coast towns, such as Dover, and other towns which are situated near the cost, such as Sunderland and Newcastle, a part, if not all, of the refuse of the town is taken to sea in barges, and there disposed of, but this method of disposal is a very objectionable one, its disadvantages being—(1) the system costs, with the purchase of barges, etc., as much as a refuse destructor; (2) during an onshore gale much of the refuse already tipped will wash ashore; (3) during a gale, which might last for a week, no refuse could be taken to sea, and therefore it would have to be stored somewhere; (4) the loading of the barges would, no doubt, have to be done from the piers of the harbour, and this would be an intolerable nuisance; (5) only at certain states of the tide, in most seaport towns, would the barges be able to get out of the harbour; (6) it is very doubtful if the Fishery Board will allow refuse to be tipped in the sea in the manner referred to when they really give this matter their serious attention.

It has often been suggested that a town council should purchase a piece of low-lying land, preferably of a clayey nature, well out in the country, and remote from the water supply of the town, or from any wells in villages, and use this as a tip for the refuse, and that they should purchase a traction engine with trailers to convey the refuse there. The disadvantages of this suggestion are that the rural district council would certainly object to the tipping of the town's refuse in their area, the cost of this method of disposal would be prohibitive, and when snow was on the ground the refuse could not be taken, but would have to be stored in the town for perhaps two or three weeks.

Sorting of Refuse in the Home

It has also been suggested that the refuse should be sorted in the home, and that separate receptacles should be used for receiving—(a) waste food, vegetable refuse, etc.; (b) ashes and dust; (c) other refuse, such as tins, broken glass, paper, etc. While this is very good in theory, in the actual carrying out of an ideal system of this kind many difficulties present themselves. This principle has been adopted in some towns in Germany, but has certainly not proved a success. The local authority can, however, be considerably helped by the housewife, if she will destroy by fire all the organic refuse of the house, so that there will be nothing to remove but ashes. This is an ideal state of things, but unfortunately the public have not yet been educated up to this standard.

Disposal by Conversion into Manure

There is great difficulty in disposing of house refuse to farmers, owing to the large quantity of paper which it contains, and which the farmer naturally objects to place upon his land. In order to pulverise refuse and make it useful as a manure a factory was erected at St. Ouen (Paris) in [illegible], and two further factories were erected—namely, at Issy-les-Moulineaux and at Romainville. Shortly after the farmers began to purchase this manure, and found it excellent; but after they had treated their land with it for three or four years they found that its beneficial effect had lessened—the land needed a change. They discontinued using the manure, and the companies failed.

Patent Lightning Dust Manipulator

This machine has been brought out by a British firm, and is undoubtedly the best of its kind.

The object of the plant is to treat the refuse so as to enable it to be used as a valuable fertilising agent. The plant may be described briefly as follows: A high-speed centrifugal-force disintegrator, pulveriser, and mixer of a simple construction, it costs much less than a destructor, occupies little room, requires only a moderate power to drive it, and any material capable of pulverisation is instantly disintegrated and pulverised; the machine is certainly a very useful one. The house refuse is tipped by the ash cart in front of the manipulator, and is then shovelled into the hopper of the machine. Almost anything can be treated, and a few seconds after the refuse is discharged into a cart or truck in the nature of a dark-coloured mould or manure. The refuse may contain rags, paper, cinders, glass, pots, bottles, or almost anything.

It was first adopted by the Southwark Borough Council, and one or two extensions of the plant there have since been made. On one occasion at Southwark 6 tons of condemned rabbits from Australia, 5,000 in number, and in their skins, were passed through the manipulator and promptly turned into manure.

Three of these machines are now at work at the depot of the Southwark Council, and a fourth has been installed as a reserve.

Problems of Railway Sanitation

By E. J. McCaustland

PASSENGER railways of this country from the nature of their business offer a ready and rapid means for the spread of disease. Infected persons may occupy railway carriages and by close association with other passengers cause a wide extension of infection. The water on the trains may become contaminated. Through the common methods of toilet accommodations typhoid or other germs may be scattered abroad to pollute sources of public water supplies. The common drinking cup, the roller towel, the cake of soap, and indeed many other things, may cause trouble and should be properly guarded against. It follows from these facts that railways have been obliged to meet a public demand for cleanliness, comfort and healthful conditions in a constantly increasing degree. In addition to the more pressing demands for strictly modern methods of heating, ventilation and lighting for railway carriages there has been a further insistence upon special protection of food supplies and of the water served upon the trains. These demands, it must be confessed, have not always been based on scientific knowledge, but have been, at times, conceived in pure sentiment or urged in a spirit of retaliation or reprisal.

To meet and possibly forestall some of these difficulties the American Association of Railway Surgeons has made an attempt to get together with State and Municipal health officers with a view to prevent rapid spread of disease through the agency of the railways. If health laws can be harmonized and unified as between States a long step in advance will have been taken. To the credit of the railways it must be said that they have responded in a comparatively prompt manner to the public demand for better and safer car heating and lighting. Their ventilation systems are at least as good as those of the ordinary places of public assemblage when the difficulties of their problem are taken into account.

While the dining car service on trains is usually found to be relatively satisfactory, and reasonable care is exercised as to quality and cleanliness, yet the tra-

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[*] From the Proceedings of the St. Louis Railway Club.

velling public is not generally aware of the practice of using the dining cars as sleeping places for employees. This is a practice that should be entirely discontinued in the interests of public health. The matter has received the attention of various State authorities, but like other questions of the sort, numerous different plans for relief have been suggested and there is no general rule adopted. Whatever plans may finally be adopted, they will, of course, add to the difficulties and the expense of operation.

The quality of the water supplied to patrons by the railways should be beyond suspicion. This is of prime importance since many of the common intestinal diseases are transmitted by means of the drinking water and a supply of undoubted purity should be demanded of all who undertake to serve the public.

The Interstate Commerce Commission took action some time ago requiring all passenger railways to furnish semi-annual certificates of purity of all waters used for drinking purposes on their trains and in their stations and waiting rooms. In carrying out this regulation the various State Boards of Health have been called into co-operation and the tests have been made in State laboratories. The certificates thus secured by the railways are therefore strictly official. The effect of this order has been most excellent since it has served to unify practice throughout the country and at the same time fully satisfy the State authorities.

In the matter of handling passengers afflicted with contagious diseases only one general rule applies. Such passengers should be removed from the public conveyance at the earliest moment and placed in the hands of local health officials. In theory this is a simple matter, but in practice it is not so easy to carry out. Contagious and infectious diseases are not always readily recognized or positively identified; afflicted persons are not always tractable; local health officials do not joyously accept trouble and expense; trains must conform to schedule and conductors are human. No really satisfactory means has yet been devised to provide for the isolation and care of travellers afflicted with contagious disease, although the railways of the Northwest in conference with State health officials at Helena, Montana, in 1912, suggested regulations that have since been pretty generally adopted by the States of the Northwest.

The care of passenger cars and the provision of toilet facilities on trains have been very much improved in recent years, but without question there must be radical improvements in the near future. With all the conveniences and luxuries of this strenuous modern life, the simple, sanitary and complete removal of wastes from our palatial trains is still an unsolved problem. Furthermore, such removal as now exists, while it may satisfy the comfort and convenience of the passenger, is certain to become both a nuisance and a menace to health to other persons.

But, it will be asked, what can be done about the matter? The answer is that the time has come when we must insist that if a railroad company finds it practicable to carry large iron tanks under passenger cars for gas or for refrigerator purposes, it can and must also carry there an iron tank for sewage. If for any reason this is impracticable, earth closets with pails frequently changed may be used. Railroads must somehow cease distributing fecal and urinary matter all along their lines. The sewage tanks or pails could be emptied at selected places, either at the end of the run or, on long runs, at principal stations, precisely as water and gas are now taken into special tanks at principal stations.

The sanitation of way stations and terminals is a problem in itself. Who is not familiar with the way station privy, foul and ill-smelling, with its unscreened windows, a pollution to both soil and air, a harbor for flies and a possible centre for the spread of infection? Shall it always be so with us? How simply and cheaply might be substituted the concrete-lined pit, and concrete floor, the tight door and the screened windows, a proper ventilation shaft and a periodic system of cleaning. These changes are coming and however inequitable it may be, they are likely to precede the same standards for the average citizen.

Finally there is another phase of railway sanitation which is the direct outgrowth of modern ideas relative to the spread of disease. It is well known that the discharges from patients suffering with such diseases as typhoid fever are highly infected and capable of spreading the disease widely if allowed to pass into a body of water used as a source of supply. Now railway lines are frequently located along streams or through watersheds from which public water supplies are taken. The roadbeds of these lines are highways for tramps and for employees and passengers. It becomes necessary at times to isolate the railroad right-of-way from the area of the watershed in order to preserve the water supply from possible pollution.

Furthermore, some authorities hold that the continuous use of railway toilets is resulting in a gradual infection of thousands of miles of roadbed. Dr. Barringer, President of the Virginia Military Institute, says: "I believe that in the well-drained, but cool and moist soil under the ties and ballast of a modern railway roadbed baptized day after day and year after year with the albuminous fluids of human excrement, the bacillus typhosus once planted in this natural culture medium, will lie forever, revitalized by new infection, perhaps, but in the meantime facultative enough to meet seasonal and other changes and remain potent. Such infection will affect people living along the line by direct contact and by the pollution of brooks, creeks, wells and other sources of water supply. It will also affect the general travelling public through the clouds of dust raised from the roadbed in the passing of trains. It is well known that travel increases one's chances of typhoid, and railroad hospitals report a very high percentage of typhoid patients among section hands. These facts all offer even a more positive reason for the abolishment of the present methods of caring for the sewage from trains."

Calgary is congratulating itself on an expenditure of some $4,000,000 on building work this season. This is considered highly satisfactory in view of the slump in western building work caused by the outbreak of the European war. It is somewhat of a paradox, however, to find that the best monthly report was for August, the month in which the war started. In August the permits totalled $1,125,000. As an aside it may be pointed out that of this amount the Government elevator was responsible for $800,000, but the cheerful fact remains. It is hoped that the Government will proceed with its various city works during the coming winter. A continuation of the programme will mean an expenditure of more than a million dollars. The West needs all the encouragement it can get for a time.

Building and Equipment of Calgary's New Police Headquarters

(Staff Article)

THE City of Calgary has occupied the new Police Headquarters completed recently, a fully fireproof structure with reinforced concrete frame. The building occupies a large open site by the City Hall and is admirably suited to its surroundings. The exterior is of local red face brick with sandstone trimmings, quarried locally, the structure being five storeys in height. Construction was commenced in July, 1913, when the general contract was let. The building was practically ready for occupancy the following June, in spite of some four months' delay during the winter months.

The concrete work was completed in two months—at the rate of a storey every two weeks. The building has a frontage on Seventh Avenue of 75 feet. It is 86 ft. deep and 58 ft. 6 in. high above the basement floor, with a total floor area of 27,400 square feet and cubic contents of 344,500 cubic feet. The by-law for this building amounted to $165,000, which is a cost of 48 cents a cubic foot, the other items of heating, ventilating and plumbing, electric lighting, elevator, police cells and architects' fees and superintendence amounting to 18 cents a cubic foot. Of these, the largest single item was for the complete system of ventilation, heating and plumbing—amounting to a trifle over 8 cents a cubic foot. Electric wiring amounted to 7/8 cents a cu. ft.; elevator to 2 1/3 cents; excavation to 1/2 cent; foundations to 1/2 cent; reinforced concrete to 8 cents, and interior finish (plastering, painting, trim, etc.), to about 2 cents a cubic foot.

There were a total of 925 cubic yards of reinforced concrete placed in the superstructure. The Kahn system of reinforced concrete was used, a beam and girder design being found to be the most economical for the conditions to be met. There are seven rows of columns across the building, the longitudinal spacing being broken by the police court, which runs through two floors. This court room has a width of 30 feet and is 52 feet long, with a height of 25 feet. The floor system and ceiling girders are carried across the clear width of 25 feet. There were a total of 84 tons of reinforcing steel used, placed at a cost of from $6.125 to $6.75 a ton. The form design was simple and differed principally from the usual type for beam and girder floors in that the floor joists were laid flat. This design required about 8 1/2 feet B.M. per sq. ft. of floor area, and lumber was used about 2 1/2 times. The labor cost for forms amounted to about 1 3/4 cents per cu. ft. B.M. or 15 cents per sq. ft. of floor area throughout. The design of the reinforced concrete required an average depth of 0.85 ft. of concrete per sq. ft. of floor area, which cost from 22 to 25 cents per sq. ft., or 2 cents per cu. ft. of building. Aggregate was dumped on a plank floor alongside the mixer and was fed to the mixer by wheelbarrows. An 11 cu. ft. Cube mixer, gasoline-driven, was used, and all the concrete was hoisted in a "home-made" bucket by a 7-in. by 10 in. American Hoist & Derrick Company, double-drum, double cylinder engine. [illegible] cu. ft. hand carts were used for conveying the concrete to place in the forms.

The exterior walls consist of 8-inch hollow terra cotta curtain walls between the columns, with a 4-inch face brick veneer outside the columns and wall girders. The basement walls are of local sandstone, with interior furring, carrying the veneer wall, although the veneer was well bonded into the tile walls with galvanized, corrugated, wall ties. It would have been better, perhaps, had the brick veneer been bonded into the tile curtain walls by headers, but the local market afforded none of the requisite size hollow tile for such work and to use ordinary brick would have defeated the purpose of the hollow tile backing. The face brick used was of a smooth texture and was laid up with a fairly thin flush joint, except certain pilasters on the front elevation, which were laid with rough-textured brick and wide raked joints. The roof over the police court is used for lighting the room and consists of a flat ceiling of blank prism glass carried by a grillage of reinforced concrete beams, and covered by a peaked roof of ribbed wire glass carried on steel trusses. The interior trim is of quartered oak stained green. The walls are all plastered, with sand float finish, and tinted. The floors are oak, with oil finish.

New Police Headquarters, Calgary.

Every room is supplied with ventilating ducts and fresh air is pumped in and foul air removed by fans located in the basement and the pent-house. Two boilers of 5,000 sq. ft. radiation are set in the boiler room in the basement and supply steam for heating. A garage on one corner against the lane houses the police patrol automobile as well as two other cars. On the other rear corner is an enclosed fire tower, a gallery along the rear of the building giving indirect access from the opposite side.

In the basement are located the police cells, forty in number, of which eight are tool-proof steel, with special locking control. The eight cells for women are separated, and under the charge of a matron. On the first floor there are the offices and police court, the two floors above being devoted entirely to the necessities of the police force. There is a large gymnasium, a guard room, telephone and police control system central, photographic laboratory, etc. The top floor is occupied by the Health and Sanitary Departments.

Messrs. Thomas Jamieson McKenzie, Limited, of Calgary, were the general contractors, for whom Mr. John Malloy was Superintendent. Messrs. Campbell & Hillier, of Calgary, were the contractors for the plumbing, heating and ventilating; Noble & Wood, of Calgary, electric wiring; Otis-Fensom Elevator Company, Limited, Toronto, elevator. Sub-contracts for the plastering were let to McDonald & Ward; for interior trim and other wood work, to the Riverside Lumber Company, Limited; sheet metal work and roofing to the Sheet Metal Manufacturing Company, Limited,—all of Calgary. The cell work was let to Tease & Perse, Limited, Calgary, local agents for the Canada Steel & Wire Company, Limited. The rough face brick were manufactured by the Tregillus Clay Products Company, Limited, Calgary, and the balance by the Canada Cement Company, Limited, near Calgary. Sandstone was supplied from the quarries of the Western Canada Stone Company, Limited, Calgary.

The architects were Messrs. Lang & Major, Calgary. Mr. W. W. Hay, formerly Secretary-Treasurer of the Calgary Builders' Exchange, was supervising engineer and clerk of the works for the City until the completion of the rough work, when the active supervision was undertaken by the Department of Buildings, of which Mr. H. A. Sylvester is Superintendent.

Constructional Features of a Large New Bakery at Montreal

Of the many important industrial buildings which have been erected in the commercial metropolis of Montreal in recent years, none has more interesting features of design and construction than the large new bakery which is now being erected for Messrs. Strachan, Limited, by the Peter Lyall & Sons Construction Company, Limited.

The large extension, which is now under way, comprises a four-storey building immediately in front of and adjoining the present establishment, with a frontage on City Hall Avenue of 167 feet and a depth of 63 feet. The construction is reinforced concrete. The front will be of a buff Kittanning brick, with blue Wallace stone trimmings and copper panels and cornices.

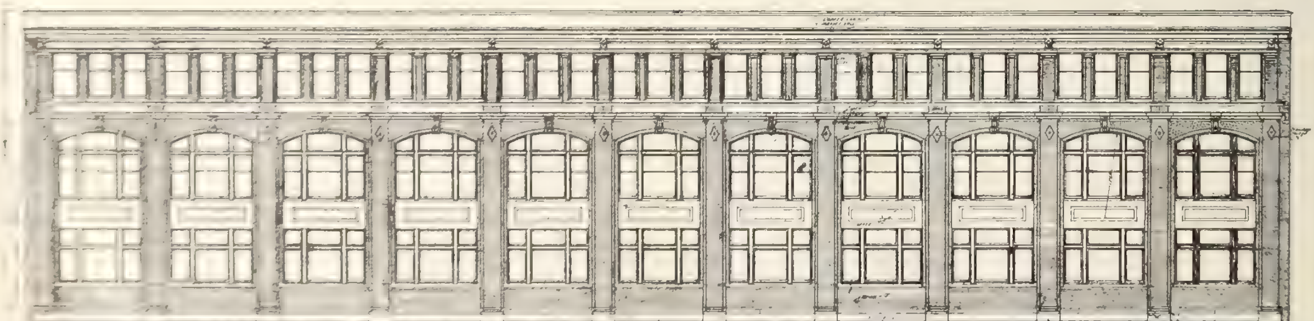
The basement is taken up by steam boilers for power and heating purposes, four large furnaces to a new travelling oven which will be installed, large fuel bunkers, general storage room, lavatories (including bathrooms), locker room, vault and other conveniences. The ground floor will be used for bread packing and loading, there being accommodation for an additional sixty wagons. These will enter and leave the building through ten large driveways, which will be closed by means of large rolling metal doors. The whole loading space will be paved with Staffordshire blue brick, and will be well drained. A separate entrance is provided to the stables, which are also being enlarged. The stables, though entirely separate from the bakery, will be accessible from the loading room.

A large freight elevator will be served from this yard, which will have direct access to both the old and the new buildings on each floor, including basement. From here also a special hoist will be provided to carry the flour directly up to the flour storage department on the fourth floor.

The main staircase will be entirely enclosed and will run from basement direct to roof. Access to the offices, which occupy the north end of the building on each floor, will be through an imposing and spacious entrance, with ceramic floor and marble dado. The staircase will be of ornamental iron with marble treads and will lead directly to the enquiry office on the second floor.

On the second storey, in addition to the new travelling oven, which will provide baking space 90 feet by 9 feet 6 inches, there will be installed a complete automatic bread plant. Provision is also made for cooling and wrapping the loaves by machinery, which will then be discharged by means of conveyors into the bread room. The finish to this storey will be metallic cement hardened.

The third floor, comprising the dough room, has an area of nearly 8,000 square feet. The temperature will be regulated automatically, and a humidifying



Front Elevation, Strachan Bakery, Montreal plant will be installed. The dough room floor will be finished in maple.

The fourth floor will be used chiefly for storage purposes.

Lavatory accommodation is provided on each storey. The floors and dados will be tiled, with marble divisions. All is exceptionally well lighted and ventilated. The lavatories in each case open off the main staircase hall and not direct from the bakery.

A laboratory, for testing and experimental purposes, will also be provided on the dough room floor.

The architect for the building is Mr. Sydney Comber, Westmount, and the general contractors are Messrs. Peter Lyall & Company, Limited, Montreal. Messrs. Purdy & Henderson are the consulting engineers. Messrs. F. J. Jago & Company are the contractors for the reinforced concrete. The automatic plant is being installed by Messrs. Jos. Baker, Limited, Brantford and New York. The particulars here given are abstracted from a comprehensive article in the "Baker and Confectioner," Toronto.

The Year's Building at Montreal

(Staff Article)

THIS has been a comparatively lean year for Montreal and district contractors and allied firms. It was generally expected there would be a lessening of the previous activity, but no one was prepared for the great falling off which has taken place. While the war is responsible for a portion of this dullness, conditions prior to the outbreak were not favourable to a continuance of the expansion which characterized the previous two or three years. In certain directions, there has been over-building; the number of large offices erected is out of proportion to the demand, with the result that both in the up-town districts and down-town districts there is an abundance of this class of accommodation. Up to this year, there was a scarcity of small houses and flats, and many contractors therefore gave more attention to this work; the emigration, however, was not as large as in previous seasons, and consequently there is not the eager demand for residences as was formerly experienced. Naturally the war affected the earning power of many people, and this in turn had an influence on the renting of houses. The building permits give a fair indication of the general situation: Up to the end of November the value of permits issued was $17,277,311, a loss of $8,446,556, the decreases being most marked since the declaration of war.

Directly following the European conflict, work on many buildings was stopped, impending contracts were postponed, and some that had just been closed were cancelled. On certain structures work has not been resumed, or only on such portions as could not be delayed. The banks, too, declined to make the customary advances, and this has tied up other jobs which would otherwise have been completed. The partial breakdown of the contracting business severely hit many of the supply houses. [illegible] factory business with country firms, who were fairly well provided with contracts, [illegible] factor in keeping things going.

The Montreal labour situation has been more or less disturbed during the season. The General Contractors' Association concluded arrangements with some unions for a schedule of wages which war conditions made impossible in the case of many firms outside the association. As a matter of fact, there has been a large defection from the standard rates, due to the [illegible] that owing to scarcity of work the men were willing to accept considerably lower pay. Contractors who based their bids on this reduced scale were able to secure jobs at the expense of the firms who attempted to adhere to the scale previously in force. [illegible] by the Builders' Exchange to secure the consent of the unions to a modified scale with a view to inducing capitalists to recommence building, but the Unions vigorously protested against any attempt to cut wages, while several members of the Exchange were opposed to the movement. Some contractors were willing to co-operate by building at cost, in order to keep their men and plants employed; and the supply men also offered to reduce prices. The net result was that no definite action was taken to encourage the giving out of contracts during the fall.

The principal work of the season was in the direction of industrial plants. We have already described the immense plant of the Canadian Vickers, Limited, at Maisonneuve, which establishes a new industry in the city; on the south shore, at Longueuil the Armstrong-Whitworth Company, of England, have put up a large plant for the manufacture of high speed steel and tools; while in Montreal proper the Northern Electric Company are erecting a very extensive factory for making wire and cable. Outside the city there is the hydro-electric plant of the Cedars Rapids Manufacturing and Power Company, one of the most complete on the continent, which will supply Montreal as well as the Aluminium Company, at Messina, N.Y., with a large amount of power.

Among office buildings, first place must be given to the Sun Life, which is now nearing completion. The Drummond and Lewis Buildings are also important in this class of structure; the Guarantee Trust have erected a moderately sized building, while the Royal Trust have finished one of the finest office buildings in the c,ty. The National Trust Company are putting up a new office in St. James Street; the Dandurand and Southam Buildings are completed, and the Liverpool & London & Globe office is nearly finished. Several contracts for banks have been given out.

The new customs warehouse is a very imposing structure; the foundations gave a considerable amount of trouble owing to the unlooked for character of the ground, and this resulted in the Foundation Company being called in. The Government have also erected some post offices, the principal being on St. Catherine Street West and on Greene Avenue, Westmount. A new drill hall has been constructed on Esplanade Avenue.

A very large departmental store, Scroggie's, was opened during the year, this being the only work of this nature to report. The Bell Telephone have made two or three additions, the largest being on St. Denis Street.

Several churches and schools have been or are being built. St. Michael's Roman Catholic Church will be one of the most ornate in the city; an addition to St. Patrick's Church is practically finished, while the Stanley Street Presbyterian Church and the Dominion Methodist Church, Westmount, are additions to the ecclesiastical architecture of the districts. The new High School is the most important of the schools. A very extensive college, Loyola College, to cost $100,000, is being erected at Notre Dame de Grace, and an orphanage, involving an expenditure of $175,000, is going up in the same neighborhood.

In Maisonneuve, apart from the buildings already referred to, the chief work has been the construction of a civic market.

The City of Montreal have done a large amount of work, although financial conditions have been against any very heavy outlays on municipal buildings. A civic library is to be erected, while a considerable outlay was necessitated for a new intake pipe for the water supply.

The Canadian Northern Railway Company have continued their work on the Mount Royal tunnel, and also propose to erect a temporary station to deal with the traffic. The Canadian Pacific have spent further large sums on the Windsor Station, and in laying out new tracks, sheds, lighting, etc.

Personal Mention

Mr. I. S. Osborn, Consulting Engineer, Toronto, Ont., has been retained to assist Mr. J. W. Paxton, Superintendent of the Street Cleaning Department of Washington, D.C., in the preparation of plans for a system of refuse collection and disposal.

Mr. A. D. Swan, consulting engineer and late assistant engineer to the Montreal Harbour Commissioners, Montreal, has returned from a two months' trip to England. He was formerly connected with the Bristol docks, and his visit was in connection with a lawsuit by Sir John Aird & Company, contractors, against the Bristol Corporation for work on the new Avonmouth docks. Mr. Swan gave evidence for the Bristol Docks Committee, who won their case against the contractors. The arguments were heard by an arbitrator.

Mr. Clifford Older, the author of an interesting paper entitled, "Floors for Steel Highway Bridges," read at the Convention of the American Road Builders' Association in Chicago last week, and reproduced in this issue, is a graduate of the University of Wisconsin. For a time he was employed by the Pennsylvania Lines in their Bridge Department and later he became identified with the Maintenance Department of the same company. From July, 1901, to April, 1902, he was Assistant Engineer on the Green Tree Tunnel Construction of the Wabash & Pittsburg Terminal Railroad. For a period of some four years, terminating in July, 1906, he was Assistant Engineer in charge of construction on the Western Division of the Chicago and Alton Railroad. Since the last-named date until the present time, he has been Bridge Engineer of the Illinois State Highway Commission, and has contributed many interesting technical papers and discussions out of his broad, practical experience. Mr. Older is an Associate Member of the American Society of Civil Engineers.

Mr. Clifford Older.

Mr. Sydney B. Williamson, of the well-known contracting firm of Messrs. J. G. White & Company, Limited, London, England, has been appointed Chief of Construction of the United States Reclamation Service, a newly created office. Mr. Williamson is the well-known Division Engineer of the Pacific division of the Panama Canal. Since the completion of Panama Canal he has been with J. G. White & Company, of London. He will spend the greater part of his time in the field, his particular function being to expedite construction work, and to secure the greatest possible efficiency.

Mr. H. M. Passmore has been appointed Secretary to the Ontario Public Works Department.

Mr. J. W. Pugsley is the new Secretary of the Department of Railways and Canals, Ottawa.

Mr. W. F. Gronau, Chief Sales Agent of the Dominion Bridge Company, Montreal, has been in Vancouver in connection with the Second Narrows bridge tenders.

Mr. W. A. McLean, Chief Engineer of Highways, and Commissioner of Public Roads for Ontario, was in Chicago last week fulfilling his part as presiding officer at the convention of the American Road Builders' Association.

Mr. G. G. S. Lindsey, K.C., of Toronto, President of the Canadian Mining Institute, delivered an address, "The Business Ethics of the Engineer," before the Engineering Society of Queens University, Kingston, on Tuesday, December 15th.

Mr. Samuel Hale, who for some years has been Manager of the Algoma Steel Corporation, Sault Ste. Marie, Ont., is about to retire from that office owing to ill-health. Mr. J. F. Taylor, President of the Company, will take charge of the operation of the plant.

Mr. W. F. Graves, A.M. Am. Soc. C.E., Chief Engineer of the Montreal Tramways Company, has been selected as one of a committee of three to make a valuation of the track property of the Detroit United Railways Company, for the Michigan Railroad Commission. Mr. Graves was formerly with the engineering staffs of the elevated and surface street railways of Chicago.

Convention News

The annual meeting of the American Society of Heating and Ventilating Engineers is to be held in the Engineering Society's Building, New York City, January 20-22. The Secretary is Mr. J. J. Blackmore, New York City. A further announcement regarding the convention will be published in due course.

In regard to the approaching convention of the American Society of Engineering Contractors, which—as already announced in these columns—is to be held in New York City on January 15th, the Secretary, Mr. J. R. Wemlinger, informs us that there will be an afternoon session for business purposes, and an evening session, which will be brought to a close by a banquet. The banquet will be enlivened by a number of entertaining features, including music and moving pictures. The Committee for Arrangements is preparing a report and further details will be given in a later issue.

The Society of Constructors of Federal Buildings are to hold their annual convention at Washington, D.C., January 4-6, as already announced in these columns. The Secretary, Mr. T. R. Maul, of Philadelphia, has kindly favored the Contract Record with the following additional particulars: The headquarters of the Society during the meeting will be at the Ebbitt House, and the meetings will be held at the rooms of the Washington Architectural Club. The opening session will be held at 2 p.m. on Monday, January 4, when reports will be received and various routine business carried out. In all there will be six sessions, two each day, devoted mainly to papers and discussions. On Wednesday there will be a dinner and smoker at the Ebbitt House. During the meetings of the Convention papers will be read or addresses made by the Hon. W. G. McAdoo, Secretary of the Treasury; Mr. Byron Newton, Assistant Secretary if the Treasury; Mr. Oscar Wenderoth, Supervising Architect; and various members of the Field and Office force of the Supervising Architect's Office.

Mainly Constructional

East and West—From Coast to Coast

The new town of Burlington, Ont., will expend $90,000 on sewer construction.

The Walkerville Roofing Manufacturing Company, Limited, Walkerville, Ont., has been incorporated with a capital of $60,000.

The ratepayers of Sarnia, Ont., are to vote next month on a by-law looking to the erection of a new city hall at a cost of $60,000.

At Calgary, work is to be started immediately on a trunk sewer estimated to cost $246,000. Mr. A. W. Ellson Fawkes is the engineer.

Tenders are about to be called by the Ottawa City Council for a new bridge, of the Bascule type, over Pretoria Avenue. The estimated cost is $120,000.

Brantford, Ont., ratepayers are voting next month on a by-law to raise $100,000 for the completion and extension of a water-works system now under construction.

The Letourneau College at Maisonneuve was destroyed by fire last week at a loss of $120,000. The building was owned by the Christian Brothers of Montreal.

Ridley Kennedy, Limited, is the name of a new firm with head office at New Westminster, B.C., incorporated with a capital of $10,000, to manufacture motor trucks and automobiles.

The London, Ont., City Council has authorized the immediate construction of sewerage works estimated to cost $14,000. This is with a view to relieving the unemployment situation.

The Taylor Engineering Company, with head office at Vancouver, has been incorporated with a capital of $50,000, to manufacture and deal in mechanical and electrical appliances and machinery of all kinds.

Large quantities of building material will be required for the new grain elevator which is to be erected at Vancouver at a cost of $1,000,000. The general contractors are Messrs. Barnett & McQueen, Vancouver.

The property and plant of the Imperial Cement Company, Limited, Owen Sound, which was advertised for sale recently, has been withdrawn from the market, the owners having made a satisfactory settlement for the continued operation of the factory.

The new school building which is being erected at Hochelaga, Que., has reached the roofing stage. The school is of stone and brick construction and will cost, upon completion, [illegible]. The architects are Messrs. [illegible] and the general contractor is Mr. J. A. Duchocher.

Exterior work on the new Loyola College, which is being erected at Notre Dame de Grace, Montreal, at a cost of $100,000, is progressing satisfactorily. The building is of [illegible] construction. The architects are Messrs. Peden & McLaren, and the general contractors are Messrs. Anglins, Limited.

At [illegible] the new building erected for the Public School Commissioners at a cost of $50,000 [illegible]. The building is two storeys high of [illegible] brick construction. The architect is Mr. J. Turner and the general contractors are Messrs. Read, McDonald & Brewster.

The A. B. See Electric Elevator Company of Canada, Limited, are taking [illegible] equip a [illegible] in future they will manufacture everything in connection with their elevators. This company will place large orders for machinery at an early date.

The decrease in building at Montreal and other cities and towns on the St. Lawrence is reflected in the tonnage of sand sent through the Lachine Canal. During the past season 65,713 tons went up the canal, a falling off of 15,775 tons; the quantity sent down was 68,644 tons, a decrease of 33,755—the total decrease being 49,530 tons.

At the annual meeting of the Hamilton, Ont., Builders' Exchange, last week, the following officers were elected:—President, Mr. T. C. Pearce; First Vice-President, Mr. W. Murray; Second Vice-President, Mr. W. H. Dennis; Treasurer, Mr. J. Neil; Directors, Messrs. G. Metcalf, G. Hannaford, W. H. Yeates, Jr., W. Penny and E. R. Somerville.

Proposed Free Labor Bureaux

WITH the object of asking the Government to introduce a Bill for the immediate establishment of free Federal labor bureaux throughout the Dominion, a deputation interviewed the Hon. W. T. Crothers, Minister of Labor, at Ottawa, on December 14. The deputation included Messrs. J. E. Adamson, Secretary of the Builders' Exchange, Ottawa; F. Hawkins, Secretary of the Canadian Lumber Association; H. Mattice, representing the Ontario Confederation of Labor; and R. L. Werry, Secretary of the Builders' Exchange, Montreal. It was pointed out that such bureaux were in successful operation in England and the United States, and it was urged that the Canadian Government should try the experiment, if only on a small scale. It was also said that the present system was a scandal, and devoid of all co-operation. The suggested bureaux would supply a means of finding work for people of all classes. Wages had been forced down in every department, and Mr. Werry pointed out that in Montreal the labor situation, so far at any rate as the building trade was concerned, was disorganized. Government control would be a most important factor in preventing distress, and if the bureaux did not create work, at least they would be instrumental in finding it for those who wanted it. The deputation asked for a non-partizan commission to manage the bureaux.

Mr. Crothers' reply was not particularly encouraging. He said that labor bureaux would cost a very large sum, and the Government could not raise money for any project that was not imperative. At the present time lumbermen were able to get any amount of labor for the camps at considerably reduced rates, while the owners of the limits obtained these at comparatively low rates. He would place the question of the bureaux before his colleagues in the Cabinet.

Victoria Branch, Can. Soc. C.E.

At the annual meeting of the Victoria Branch of the Canadian Society of Civil Engineers, the following officers were elected: Chairman, Mr. D. O. Lewis; Vice-Chairman, Mr H. W. E. Canavan; Treasurer, Mr. Frank C. Green; Secretary, Mr. R. W. McIntyre; Executive—Mr. A. E. R. Wilby and Mr. A. E. Foreman; Auditors, Mr. E. H. Harrison and Mr. H. A. Icke.

An interesting address was delivered by Mr. E. C. Gamble, who had been Chairman of the Branch [illegible]. Mr. Gamble made a plea for united effort and said that the [illegible] members sacrificed their personal aims. He lamented the [illegible] regard.

A New Device for Tying and Supporting Reinforcing Bars

LEADING designers have long realized the necessity for a positive placing of the reinforcing steel, and usually detailed drawings show the theoretical position of the bars. For instance, the ordinary way of keeping the reinforcing bars from showing on the under side of the slab is to have a laborer raise the bars from the forms with his shovel blade, a hook made specially for that purpose, or to rest the bars on stones before concreting. Such methods rarely result in satisfactory work as there is no gauge to determine the final position of the bars. If they have been raised too high they lose some of their efficiency and if not raised enough the fireproofing qualities have been lost.

In order to insure that the bars are placed the proper distance from the face of the forms, metal clips are frequently used. These are made of a heavy weight and good quality of sheet steel. The accompanying illustrations show the Universal Concrete Bar Support and Tie, which supports and ties the reinforcing bars in their proper position. It is made for all kinds and sizes of bars.

The U Support-Tie is made from a single piece of metal stamped from heavy gauge steel, which has ample strength against crushing down under practically any load that can come upon it. The bottom edge of the tie is bent to form a flat foot and prevent cutting into the forms when used on flat slab construction. Due to the great strength and rigidity of this tie fewer of them are needed than of wire and the manufacturers inform us that they recommend one U-Support where two wire intersections are called for. The standard height of leg is ¾ in., being measured from the bottom of the lower bar to the form. They can also be had in any length leg from ½ in. up.

The use of this clip eliminates having to untangle wire, straightening straps and placing of wedges. An ordinary claw hammer clinches the tie in place. For those builders dependent on the ordinary run of day labor for placing their steel, the manufacturers furnish a Clincher which clinches the tie in place at one operation.

The U-Truss Support-Tie is for use where the clearance is more than two inches. For the trussed portion of the bars in flat slab construction and in bridges, viaducts, etc., it insures the steel being in its proper position.

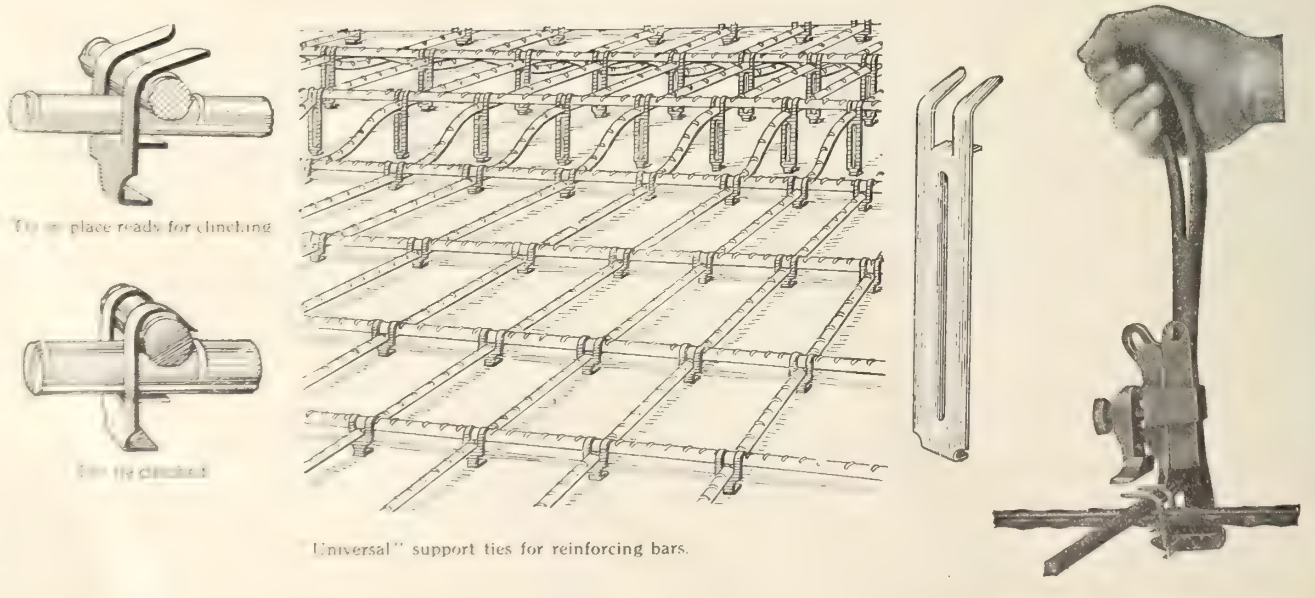
These Support-Ties are made by the Universal Stamping Company, Limited, Strasburg, Lancaster County, Pa., and are handled in Canada by Mr. R. J. McLean, 800 McGill Building, Montreal.

Opening of the Armstrong-Whitworth Plant at Longueuil, Que.

THE new plant of Messrs. Armstrong-Whitworth of Canada, Limited, at Longueuil, which was opened recently, represents an expenditure of $1,250,000. The layout and construction of the works, which has been under the direction of Mr. M. J. Butler, has been in progress for some two years. The company will employ a large force of skilled workmen in the manufacture of the highest grade of steel goods. The area of the property owned by the firm at Longueuil is 250 acres, extending down to the river front. Steps have been taken to secure the dredging of the river, so as to permit of the company's landing supplies and shipping their output at their own wharfs. The floor area of the units now at work covers 65,000 sq. ft. At present about 150 men are at work, but this number will soon be increased to 500. Expert steelworkers are being brought from Sheffield and other cities.

The opening of the works, which was performed by Mr. Geo. D. Foster, K.C., vice-president of the firm, was of a ceremonial character in keeping with the occasion. After the opening a number of interesting addresses were delivered. Among these was one by Mr. M. J. Butler, who told something of the achievements of the parent company in Great Britain and foreshadowed the possibilities of the Canadian establishment.

Among those present at the opening were: Mr. W. P. Ladd, Works Manager, St. Lawrence Bridge Company, Limited; Mr. John Russell, Canadian Explosives, Limited; Mr. W. J. Johnson, Superintendent, Canadian Car & Foundry Company, Limited; Mr. E. B. Tilt, Engineer of Tests, Canadian Pacific Railway Company; Mr. P. L. Miller, Manager, Canadian Vickers, Limited; Mr. J. A. Johnson, Superintendent, Steel Company of Canada, Limited; Mr. Geo. Cuttle, Steel Company of Canada, Limited; Mr. F. A. Smith, Works Manager, Canadian Steel Foundries, Limited; Mr. G. H. Duggan, Manager, Dominion Bridge Company, Limited; Mr. Jos. Waldie, Manager, Canadian Tube & Iron Company; Mr. D. Swinton, Superintendent, Canadian Car & Foundry Company, Limited.



Tie in place ready for clinching

Tie clinched

"Universal" support ties for reinforcing bars.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Battleford, Sask.
The town council will submit a by-law on December 28th to authorize the raising of $6,100 for cement sidewalks and $1,000 for cement crossings. Mr. H. C. Adams is the town clerk.

Calgary, Alta.
The by-law having been passed some time ago by the city council, work will be started at once on the construction of a trunk sewer, estimated to cost $246,000. Mr. A. W. E. Fawkes is the engineer.

Hamilton, Ont.
The laying of fifteen miles of gas mains along streets of this city for the Natural Gas Company has been commenced by the general contractor, Mr. J. D. Armstrong, 138 Erie Avenue.

Kamsack, Sask.
Work will start December 24 on the construction of branch sewers on the following streets, at an estimated cost of $35,000; 2280 ft. of 10-in and 12-in. pipe on Railway Street; 1433 ft. of 10-in. and 12-in. pipe on Third Avenue; 2640 ft. of 8-in. pipe on First Street; 1685 ft. of 8-in. pipe on Second Street; 1140 ft. of 8-in. pipe on Third Street; 1406 ft. of 10-in. pipe on Kamsack Blvd.; 1020 ft. of 8-in. pipe on Third Avenue; 875 ft. of 8-in. pipe on Hudson Bay Avenue.

London, Ont.
Work by day labor is to be started on the construction of storm sewers to cost $13,000 and sanitary sewers to cost $1,200 on Oxford Street and Ridgeway. Mr. H. A. Brazier is the engineer.

Moose Jaw, Sask.
The city council has purchased 400 ft of land in River Park, 75 ft. wide, for roadway and approach to River Park bridge. Proposed paving work is estimated to cost [illegible]. The city engineer is Mr. Geo. D. Mackie.

Orillia, Ont.
The contract for installing [illegible] 18-ft. horizontal filters in connection with the [illegible] waterworks scheme for the town has been awarded by the Town Council to the International Filter Company, Chicago, the contract price being $14,465. Mr. W. K. Greenwood, West Street, is the engineer

Ottawa, Ont.
Work is started on pavement between Metcalf and Driveway, to include tarvia surface at an estimated cost of [illegible]. Surface drainage has been started by day labor. Mr F. C. Askwith is the city engineer.

Port Hope. Ont.
Messrs. Smith and Smith, Consulting Municipal Engineers, [illegible], are preparing plans and specifications for about 4,000 feet of sewers, about 3,000 ft. being a trunk sewer for the purpose of serving the westerly section of Port Hope, south of Ridout Street.

Saanich, B.C.
The Municipality of Saanich will start work immediately on road improvements, estimated to cost $30,000. The scheme includes the extension and widening of Shelbourne Street from North Dairy Road to Mount Douglas Park. Mr. Hector S. Cowper is the city clerk.

Stratford, Ont.
A by-law will be submitted for the construction of tarvia pavement on concrete base, on Douro Street at a cost of $4,155; Romeo Street $6,333 and Albert Street, $3,762. The contract will be let next spring. Mr. A. B. Manson, City Hall, is the engineer.

Toronto, Ont.
The city council has approved of the opening of a road through Mount Pleasant Cemetery. Estimated outlay $275,000. Work will start shortly. Mr. R. C. Harris, City Hall, is Commissioner of Works.

The opening of a roadway through Prospect Cemetery has been approved by the city council at an estimated cost of $30,000. Construction will begin shortly.

Work is to start on the construction of about 1,000 feet of 21-inch watermain on Davenport Road near Bathurst St. Estimated cost $4,500. Work will be carried out by day labor. Mr. R. C. Harris is Commissioner of Works.

A by-law has been passed authorizing the construction of a sewer on Oakwood, estimated cost $8,000, and on Conway at a cost of $3,000 for York Township Council. Mr. F. Barber, 57 Adelaide Street East, is the engineer. Mr. W. A. Clarke, 40 Jarvis Street, is the Township Clerk.

Victoria. B.C.
The city council has raised $130,000 for the commencing of work immediately on the Sooke Waterworks System. Messrs. [illegible] & [illegible] are the consulting engineers. Mr. Ferguson, care engineers, will supervise the work.

CONTRACTS AWARDED

Toronto. Ont.
The board of control has awarded the following contracts for paving supplies: [illegible] crushed trap rock, Ontario Rock Company, [illegible] special castings, Don Foundry Company, Toronto; brass and bronze castings, Canada Metal Company, Toronto. Mr. R. C. Harris, City Hall, is Commissioner of Works.

The following contracts for concrete work have been transferred from the Works Department: Concrete walk on Patterson Avenue, Ramsay Contracting Company, at $1.11 per foot; concrete curbs on Inkerman Street, Godson Contracting Company, at 35c per foot.

Winnipeg, Man.
The board of control has let the following contracts for sewer construction work:—sewer on Jubilee Avenue, from Helen Street to Pembina Highway, $37,000—Mr. J. W. Astley, Engineer of Construction; Clifton Street, from Richard and Notre Dame—Thos. Jackson & Son, $10,000; Clifton Street, from Weston to Roy Avenue, $19,000—Mr. E. F. Campbell. Mr. W. P. Brereton, 223 James Avenue, is the engineer.

Railroads, Bridges and Wharves

London, Ont.
A temporary shed to replace those destroyed by fire recently, will be built here by the G. T. R. Owners will do all work and supply material. The building will be one-storey, 50 x 400 feet, frame construction. Mr. D. W. Hayes, London, is the agent.

The ratepayers of this city will vote December 28 on a by-law to authorize the construction of a bridge across the Thames River at Richmond Street, estimated to cost $40,000. Mr. S. Baker is city clerk. Mr. H. A. Brazier is the engineer.

Medicine Hat, Alta.
The Railway Board of Commissioners have authorized that plans and estimates be prepared by the city council within three months for the construction of an overhead bridge across Ottawa Street. Mr. Herbert Baker is city clerk. Mr. A. K. Grimmer is the engineer.

Ottawa, Ont.
Tenders will be received by the Secretary, Board of Control, until [illegible] for the construction of the substructure of a bascule bridge across Pretoria Avenue at a cost of $120,000. Plans and specifications are with Mr. F. C. Askwith, City Engineer, and at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

St. Thomas, Ont.
The London & Lake Erie Transportation Company, St. Thomas, have in contemplation plans to install new switches and lay new tracks at M. C. R. Crossing. Mr. G. W. Warburton, London, is the manager.

CONTRACTS AWARDED

Toronto, Ont.
The Hamilton Bridge Works, Hamilton, have secured the contract for the steel work in [illegible]

Street [illegible] (Dam Sections), at approximately station. The general contractors are Messrs. Quinlan & Robertson, Montreal. Mr. R. C. Harris is Commissioner of Works.

Public Buildings, Churches and Schools

Belleville, Ont.
Belleville Club Limited have let the following contracts for $20,000 Club House to be erected at the corner of Bridge and Pinnacle Streets—three-storey, 30 x 80, brick construction: Mason work, Mr. J. Lang, Superintendent of Construction; carpentry and interior fittings, Mr. John Hynes; plastering, Mr. John Weir. The contract for painting has not yet been let.

Battleford, Sask.
The ratepayers of this town will vote on December 28th on a by-law to raise $7,000 for completion of town hall. Mr. H. C. Adams is town clerk.

Balermo, Alta.
Bellgrove School District No. 2390 is raising funds for the erection of a school building here. Mr. R. T. Bell is treasurer.

Downie Township, Ont.
Tenders will be received until December 28 by Mr. T. Ferguson, R. R. No. 1, Carlington P. O., Secretary of S. S. No. 7, Downie, for remodelling school building, also installation of furnace. Plans and specification are with Mr. W. F. Ballantyne, Lot 16, Con. 9, Downie.

Guelph, Ont.
All work will be done by day labor on the construction of $50,000 Physics Building on Model Farm, for the Provincial Government Department of Public Works. Brick and tile are being supplied from the Government plant.

Hochelaga, Que.
The School Commissioners of this district will purchase interior fittings in about three months' time, in connection with $182,000 school building which is almost completed on Chambly Street. Mr. W. Desjardines, 236 Chambly Street, is secretary-treasurer.

Kimmundy, Alta.
The Flaxland School District, No. 2988, has been authorized by the Provincial Government to raise $1,300 for the erection and equipment of a school building here. The treasurer is Mr. J. O. Carter, Kimmundy.

Kingman, Alta.
Kingman School District No. 2867 have been authorized to raise $1,900 to erect and equip a school building here. The treasurer is Mr. T. J. Rogness, Kingman.

Logan, Alta.
The Provincial Government have authorized the Mackenzie School District No. 234 (Mr. C. C. Roberge, Logan, treasurer), to borrow the necessary funds to erect a school building here.

Lamont, Alta.
Maybridge School District, No. 2928, has decided to raise $1,200 for the erection of a small school building. Mr. R. Fletcher, Lamont, is the treasurer.

Langdon, Alta.
Fairplay School District No. 2682 will erect and equip a school building and provide fencing. Mr. E. B. Welsheimer, Langdon, is treasurer.

La Calmette, Alta.
Elk Park School District, No. 2962 (Treasurer, Mr. Geo. Miller, La Calmette), will raise $1,400 to provide for the erection of a school building here.

Maisonneuve, Que.
Tenders for heating will be called shortly in connection with the construction of a public bath for the city council at an estimated cost of $150,000. Tenders are already in for the supply and erection of steel, also the brick and stone work in the superstructure. The base of the building will be of cut granite. Plans and specification are at office of architect, Mr. Marius Dufresne, Ontario and LaSalle Streets.

Milverton, Ont.
Tenders will be received until 4 p.m., January 4, by the Dominion Government Department of Public Works, for interior fittings in post office and customs house. Fittings will include oak and wire screens, wickets, shelving, doors, counters, desks, cupboards and wardrobe, door springs, blackboard and plate glass. Plans and specification are at office of Mr. Wm. Hartmier, Clerk of Works, Milverton; Mr. T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and at Department, Ottawa. Specification is at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Oakville, Ont.
A money by-law for $10,000 has been carried by the ratepayers for the purpose of erecting municipal offices and a fire hall. The work will be proceeded with in the spring.

Pilcox, Alta.
Alhamber School District, No. 2930 (Mr. J. R. Kerr, Pilcox, treasurer), has decided to borrow $1,200 for a new school building.

Shediac, N.B.
Interior fittings will be purchased shortly for new $50,000 church building by the architect and superintendent of building, Mr. R. A. Frechet, 30 Bonnacord Street, Moncton.

St. Epiphane, Que.
Tenders will be received until December 26th by the Rev. A. D. Jobin, Parish of St. Epiphane, for the contract to carry out restoration of church and dependencies of parish, also for hot water heating system. Plans and specification are at office of architect, Mr. Thos. Raymond, 45 Caron Street, Quebec, Que.

Sussex, N.B.
Prices on interior fittings are being taken by the general contractor, Mr. Walter F. Lutz, Court Street, in connection with $28,000 Agricultural College, two-storey, brick construction, for Provincial Government Department of Public Works. Mr. G. E. Fairweather, 84 Germain Street, St. John, is the architect.

St. John, N.B.
Interior fittings for $80,000 Tuberculosis Hospital for the city council will be purchased about January 1st by the architect, Mr. F. Neil Brodie, 42 Princess Street.

Stoppington, Alta.
Crocus Plains School District No. 2693 (Mr. W. H. Bird, treasurer), has been authorized to borrow $1,200 for the erection of a school building here.

Tollerton, Alta.
Tollerton School District, No. 2878, has been authorized to borrow $2,200 for the erection and furnishing of a school here. The treasurer is Mr. Alex Thomson, Tollerton.

Toronto, Ont.
Tenders close December 29 with Mr. W. C. Wilkinson, secretary-treasurer, Board of Education, for plumbing, steam fitting, tinsmith and steel lockers in connection with several schools; also plastering Williamson Road School, and equipping Pape Avenue School with an ash hoist. Plans, etc., are at the office of the Superintendent of Buildings.

The Board of Education proposes establishing a farm and constructing the necessary buildings, etc., for taking care of the feeble minded. The scheme has been endorsed by the city council, but the site has not yet been purchased. Mr. W. C. Wilkinson is secretary-treasurer, Board of Education.

Tenders will close on December 29th, 1914, with the architect, Mr. H. B. Knowles, 1170 Broadway, New York City, and with the supervising architects, Messrs. Burke, Horwood & White, Ryrie Building, Toronto, for contracts as follows on $300,000 Masonic Temple Building on Spadina Road for the Masonic Corporation of Toronto, Limited:—General construction, common, faced and enamelled brick, buff Indiana limestone and gray Canadian granite (Stanstead or equal); terra cotta fireproofing (equal to National Fireproofing Company). Structural and hollow steel, wrought and cast iron. Floors—Cement, terrazzo, mosaic, tile, marble composition, pine, red and white oak. Roofing—Felt and slag, galvanized iron, skylights, cornices, copper flashings. Plaster—Lathing and furrings, ornamental and hard wall plaster, Keene and Caenstone cement work. Interior work—Botticino and gray Tennessee marble, terra cotta (polychrome and book tile), ornamental iron and bronze tablets, grilles, frames, cast brass, wrought iron railings, ladders, bars, fire escapes, slate stair treads, lockers, weather strips, refrigerators. Glass—Common, leaded and cathedral. Hardware—Mostly cast brass and bronze, Yale & Towne standards. Elevators—2 electric passenger and one ash hoist, dumb waiters. Plumbing and gas fittings—Hot water tank and boilers, 34 water closets, 30 urinals, 27 wash basins and 10 stop sinks. Electric lighting—Switchboards, etc. Steam heating—2 horizontal tubular boilers, 2 mechanical stokers (Dominion radiators or equal). Ventilating system—Centrifugal fans, 21 electric motors, thermostatic regulators. Fire alram system—Telephone conduit system, vaults. The building will be four-storey and basement, 82 x 150 ft., and will contain large assembly hall with gallery, lodge rooms, dance hall, rest rooms, banquet hall, etc. Foundation will be concrete (waterproofed) and construction will be common brick. Plans and specification are at the office of the architects. Messrs. Nygren, Tenny & Ohmes, 10 Cathcart Street, Montreal, are the consulting engineers.

Vancouver, B.C.
Tenders are in for separate trades in connection with $50,000 lodge hall for

the Fraternal Order of Eagles. No contracts have yet been awarded. Building will be three-storey, 120 x 50 feet, brick, mill and iron construction. Mr. Emil Guenther, Northwest Trust Building, is the architect.

Waugh, Alta.
The Provincial Government has authorized the raising of $1,000 by the Moon Lake School District No. 2785 for the erecting of a small school and the purchase of equipment.

CONTRACTS AWARDED

Toronto, Ont.
The following additional contracts have been awarded by the Board of Education on $45,000 School Building on Withrow Avenue: Terrazzo floors—Italian Mosaic & Marble Company, $705; heat regulation—Johnson Temperature Regulation Company, 118 Adelaide Street West, $1,129.

The Board of Education has awarded the contract for heat regulation in connection with $22,000 John Fisher school building to the Johnson Temperature Regulator Company.

The following additional contracts for Ryerson Annex to school building at a cost of $60,000 have been awarded by the Board of Education:—roofing—Douglas Bros., $533; Terrazzo floors, Orr Bros., $1,120.

Business Buildings and Industrial Plants

Brantford, Ont.
The grand stand, etc., owned by Canadian League Baseball Park, has been destroyed by fire. The extent of the damage is not reported. Mr. J. T. Nelson is the proprietor.

Chatham, Ont.
The Everlasting Caskets & Vaults, Limited, which was incorporated recently with a capital of $50,000, will rent quarters and will require equipment including drills, lathes, dies, presses, galvanized iron, bronze and copper. The ratepayers of Chatham will vote on a by-law January 4, to authorize the granting of concessions, etc. Mr. W. G. Burrows and Mr. W. W. Burrows are interested.

District of Algoma, Ont.
Wells-Higman Company, Traverse City and St. Joseph, Mich., have purchased 32 square miles of timber land on Batchawaung Bay, Townships of Tilley, Archibald and Tupper, District of Algoma. Logging operations have started and 474 feet of docks will be constructed and shingle mill, saw mill and veneer plant will also be erected.

Galt, Ont.
Tenders will be received until December 26th by the architect, Mr. J. Evans, 30 Water Street North, for all trades other than masonry and carpentry in connection with [illegible] store on Ainslie South, for Mr. R. Kerr. The building, for which [illegible] are at present being made, will be [illegible] storey, 40 x 120, Milton brick construction, concrete foundation.

Hamilton, Ont.
Drying plant, engine room, clay sheds and store room of brick plant on Dundas Street, the property of Mr. W. H. Cooper, 67 York Street, have been destroyed by fire. The insurance amounted to $10,000.

The glass factory owned by Mr. E. B. Echlin, 248 Locke Street, has been damaged by fire to the extent of $1,200.

Kingston, Ont.
Front of wall paper store owned by Messrs. Savage &. Whightman, 133 Brock Street, has been seriously damaged by fire. All fittings, etc., have been destroyed.

Montreal, Que.
Fabrique St. Marc, 2145 Rosemount Blvd., will purchase interior fittings for $19,000 Presbytery, one-storey, 40 x 110.

The upper storeys of stores and office building owned by Mr. Alex. Fraser, care of Fraser Viger & Company, 209 St. James Street, have been destroyed by fire. Estimated loss $50,000.

The contracts for roofing and electrical work on $12,500 addition to warehouse of the Canada Sugar Refining Company, Limited, 150 Montmorency Street, have not yet been let. Mr. Geo. A. Brown is building superintendent.

Interior fittings for one-storey addition to store on Notre Dame and Bisson Streets will be purchased by Mr. P. Wright. Estimated cost of alterations $3,000. Mr. W. E. Doran, 189 Bleury Street, is the architect. Mr. James McNeil is the general contractor.

Interior fittings in connection with $8,000 alterations to apartments on Sherbrooke Street will be purchased by the Consolidated Realty Company, Eastern Townships Bank Building, Montreal (owners). Building is three-storey, 50 x 150. Mr. D. J. Spence, 46 Beaver Hall Hill, is the architect.

All trades other than masonry and carpentry will be sublet soon by the owner and general contractor, Mr. Jos. Dupuis, 82 George Etienne Cartier, in connection with the construction of three-storey, 131 x 40 store and 18 flats, estimated to cost $15,000.

Preliminary plans have been drawn for placing iron and steel beams and supports and erection of new stage in picture theatre on St. Lawrence Blvd., at an estimated cost of $1,000, for the Star Land Theatre, Montreal. Mr. C. Dufort, 192 St. Catherine West, is the architect.

A permit to erect three stores on St. Lawrence, three-storey, 25 x 74, at an estimated cost of $3,500, has been issued to Mr. Z. Berard, 2474 St. Dominique Street.

Messrs. A. Bommier & Frere, 37 Jacques Cartier Street West, have been granted a permit to build one store and five flats, three-storey, 39 x 60, estimated to cost $5,000

A building permit for one store and one flat, three storey, 30 x 33, at an estimated cost of $[illegible] has been issued to Mr. A. Belisle, 2035 Chabot Street.

MacLeod, Alta.
Work has started on the rebuilding of Roseland Dairy, recently damaged by fire. Buildings and equipment will cost about $2 200. Mr. Crossley is the proprietor, Mr. J. S. Lambert, contractor.

The Dominion [illegible] Company's warehouse has been destroyed by fire involving a loss estimated at $5,000. Building and stock were insured.

Quebec, Que.
The Dominion [illegible] Construction Company, Montreal, are putting in foundations for addition to freight sheds for the Canadian Pacific Railway Company, Montreal, at an estimated cost of $200,000. The building will be one-storey, 30 x 368, 50 x 593, brick and reinforced concrete construction, felt and gravel roofing.

Shannavon, Sask.
The Empress Hotel has been burned down here with a loss estimated at $65,000.

Sackville, N.B.
Stores, offices and restaurant, owned by Mr. Alex. Ford, Sackville, have been destroyed by fire. The loss is estimated at $3,000.

Toronto, Ont.
The board of control contemplates the purchase of a lathe, estimated to cost $500, for use at asphalt plant. Mr. R. C. Harris is Commissioner of Works.

Vancouver, B.C.
Work is to proceed shortly on the interior of Immigration Building for the Dominion Government Department of Public Works. Estimated cost of building $350,000. Messrs. Geo. Snider & Berethour, Dominion Building, are the general contractors.

The stock and fixtures of tailor's shop, the property of Mr. M. Sherman, 652 Granville Street, have been totally destroyed by fire. The loss is estimated at $5,000.

Verdun, Que.
Fire equipment will be purchased early in the new year by the chairman of the Purchasing Committee, Town Council (Mr. Wm. Evely, LaSalle Road), for the equipment of a new fire station which is about completed.

Wiarton, Ont.
Store and hardware stock, the property of Mr. Jas. Flett, have been damaged by fire to the extent of about $10,000.

CONTRACTS AWARDED

Montreal, Que.
The general contract for alterations to office building for Messrs. Fineberg & Rabinovitch, St. Lawrence Blvd., including placing stairway and doorway and alterations to store front, has been let to Mr. V. Gourre, 1169A St. Andre St. Catalogues and prices on glazed vitrified terra cotta will be received by the architects, Messrs. [illegible] St. Lawrence Blvd.

Vancouver, B.C.
The general contract for $12,000 office building, one-storey, [illegible] for the Imperial Oil Company, [illegible] Street, has been awarded to the Dominion Construction Company, Northwest Trust Building. Work will start at once. Prices on all materials will be invited shortly.

Residences

Cote des Neig's, Que.
Interior fittings for thirty flats, three-storey, [illegible], which are being completed, at a cost of $20,000 for Mr. O. E. [illegible] Street, will be purchased by the owner

Guelph, Ont.
Permits to erect two-storey residences

here have been granted to Messrs. G. Fisher, Hardie Street, and J. Keleher, [illegible] Street.

Hamilton, Ont.

Mr. James Ellison, 21 Senator Avenue, has had plans drawn for a three-storey residence on [illegible] Avenue.

Halifax, N.S.

Work is to start shortly on the construction of two residences, two-storey, [illegible] x [illegible] frame construction, estimated cost $3,500, for Mr. Chas. Brister, 163 Lower Water Street. Owner will do all work and supply material.

Tenders for plastering will be received until February 28th by Messrs. Maxner & Dunlop, 52 Windsor Street and 109 Oxford Street, in connection with $7,000 residence on Cobourg Road, two-storey, 36 x 33, frame construction. Mr. Herbert E. Gates, Dennis Building, Granville, is the architect.

Hamilton, Ont.

Plans are prepared for the erection of a residence on Beechwood Avenue for Mr. R. S. Mason, 21 Somerset Street.

London, Ont.

Alterations of residence into two apartments and the construction of a frame addition at rear of each, are being carried out by Mr. R. Moore, 204 St. James Street. Mr. S. H. Foxworthy is the general contractor. In connection with the work two hot-air furnaces are required.

Work has been stopped for the winter but will recommence next spring on $3,000 bungalow, two-storey, 42 x 28, brick construction, hot air heating, hard wall plastering, for Mr. T. Munro, care Munro's Carriage Shop, Albert and Richmond Streets. Mr. A. E. Nutter, Room 15, Dominion Bank Chambers, is the architect.

Montreal, Que.

All work will be done and material supplied by Messrs. F. Tremblay & Company, 400 William Street, owner and general contractor, on the construction of 27 flats, three-storey, 180 x 47, in course of construction on St. Dominique Street at a cost of $18,000.

Plans are drawn for six flats on De Beaujeu, three-storey, 24 x 49, for Mr. Wilfrid Maille, 2228 St. Hubert. Estimated cost $3,000.

A permit to build 20 flats, three-storey, 68 x 240, at an estimated cost of $55,000, has been issued to Mr. J. H. Hand, 609 Belmont Avenue. Work on all trades and the purchasing of material will be carried out by the general contractors, Messrs. Hand & Pick, 609 Belmont Avenue.

A permit to build eight flats, three-storey, 46 x 50, estimated to cost $8,000, has been obtained by Mr. H. Dubois, 1550 Chabot Street, owner and general contractor.

Ottawa, Ont.

The construction of a $4,000 residence, two-storey, 24 x 31, brick veneer construction, stone foundation, is contemplated by Mr. Chas. Bromley, 44 Brighton Street.

Tenders are open for piling work on $30,000 club house for the Ottawa Canoe Club, Rockliffe. Piles are to be 35-ft. hemlock, prices to be per driven foot. For balance of work tenders have been received but no contract has yet been awarded. Messrs. Meredith, Findlay & Hazlegrove, 126 Sparks Street, are the architects.

Mr. Daniel Mariatz, 5 Hill Street, is erecting a residence on Stonehurst, brick veneer construction, concrete foundation, estimated to cost $4,000.

A residence on Windsor, at an estimated cost of $3,600, is contemplated by Mr. James E. Wilson, 102 Bellwoods. Residence will be 2½-storey, 32 x 34, 16 x 34, brick veneer construction.

Alterations and additions to residence, the property of Messrs. Ferguson & Lambert, 643 King Edward Avenue, are in contemplation. Building will be 40 x 60, stucco and brick veneer construction, estimated cost $6,500.

Messrs. J. & P. Murphy, 994 Bronson Street, are contemplating addition and alterations to residence on Turner at an estimated cost of $2,000.

Tenders for plastering, heating, plumbing and electrical work will be called soon in connection with $4,500 residence on Irving Avenue for Mr. E. Foster, 80 Spadina Avenue, owner and general contractor.

Stoves will be purchased by Mr. H. Lethbridge, First Avenue, who has the sub-contract for plastering $12,000 residences on Armstrong for Mr. J. W. Foster, 11 Irving Avenue, and Mr. E. Marks, 30 Spadina Ave.

Bids are wanted on plastering, painting, heating and electrical work in connection with $4,500 residence for Mr. W. J. Scobie, 201 Gladstone Avenue. Mr. A. Tracy, Gladstone Avenue, is the architect.

Prices will be asked shortly on plastering, painting, heating, plumbing and electrical work in connection with double brick veneer residence in course of erection for Mr. John McCallum, 54 Glen Avenue. Estimated cost $4,500.

Tenders will be called soon for plastering, painting, heating, plumbing and electrical work on $3,500 residence, brick veneer construction, concrete foundation, for Mr. Thos. Rock, 82 Poplar Street, owner and general contractor.

Work is being done by day labor under the supervision of Mr. James Ouelett, 65 Lloyd Street, in connection with additional alterations to residence on Sophia Street, estimated to cost $3,500.

Outremont, Que.

In connection with the construction of $13,000 residence, two-storey, brick construction, on Ainslie Street, for Mr. Garceau, 164 Desiry Street, all work is being done and interior fittings furnished by the owner. Mr. Jos. Surveyor, care owner, is the architect.

Oakville, Ont.

Hydraulic outfit will be required for pumping water to tank for bathroom and general use, in connection with $5,000 residence in course of construction for Mr. N. Lawrence. Building is 2½-storey, 28 x 33, brick veneer construction. Mr. Thos. Blacklock, care of Blacklock Bros., is the architect. Sub-contracts for electrical work and interior fittings have not yet been let.

Contracts for trades other than masonry and carpentry have not yet been let in connection with $4,500 residence on Reynolds Street, for Mr. David Chapman, Spruce Street. Residence will be two-storey, 25 x 38, terra cotta construction. Mr. F. R. Perkins is the architect and general contractor.

Quebec, Que.

Work has started on a $15,000 residence, 2½-storey, 68 x 39, brick construction, for Hon. Dorion, 10 St. Augustin Street.

River Heights, Man.

Tenders for painting and electrical work may be sublet by the general contractors, Purcer Bros., 509 McIntyre Block, Winnipeg, in connection with $11,000 residence, 30 x 32, ornamental brick and stucco construction.

Sarnia, Ont.

The construction of residence on Milton Street South is contemplated by Messrs. Walter C. Firman, 389 Cromwell Street, and Daniel Brown, 375 Cromwell Street.

Sandwich, Ont.

A loss of $2,500 has been sustained by Mr. A. J. Barge in the destruction by fire of his residence here.

Toronto, Ont.

The erection next spring of six pairs of residences similar to the two pairs at present under construction at an estimated cost of $9,000, is contemplated by the owner and general contractor, Mr. M. McLean, 90 Ashdale Avenue. Building at present under construction will be two-storey, 38 x 42, brick construction and foundation.

Apartment house owned by Mr. J. T. Benoir, Wilton Ave. and George Street, has been damaged by fire to the extent of $3,000. The loss was fully insured.

Interior furnishings, fittings, etc., for Government House, Chorley Park, are being purchased under the supervision of Mr. E. R. Heakes, Parliament Buildings, Toronto (Provincial Architect). The building is to be ready for occupation next spring. Mr. H. T. McNaughton Parliament Buildings, is Secretary, Department of Public Works.

Winnipeg, Man.

Work has been suspended until next spring on $55,000 apartment block on Yonge Street for Mr. J. E. Wilson, 258½ Portage Avenue, owner and general contractor. The building is brick construction and only the interior trimming remains to be completed. This will be done by the general contractor.

Power Plants, Electricity and Telephones

Brockville, Ont.

The Provincial Hydro-electric Commission has in contemplation the erecting of an auxiliary Power House adjoining the main Power House, which latter is to be ready for completion next spring for the power line extending from Prescott to Brockville. The construction of the auxiliary power house is estimated to cost $4,000. Mr. W. W. Pope, Continental Life Building, Toronto, is secretary of the Commission.

Dundalk, Ont.

The ratepayers here will vote January 4 on a by-law to authorize the raising of $5,000 to provide for the erection of an electric power plant to distribute power furnished by the Hydro-electric Commission. Mr. M. W. Ridley is village clerk.

Hull, Que.

Work will start shortly on the laying

of water mains on St. Catherine Street. Mr. J. A. Laforest is city engineer.

London, Ont.
The city council has authorized that work be started immediately on additional storm and sanitary sewers in this city at an estimated outlay of $14,000. Mr. H. A. Brazier is the engineer.

The Hydro-electric Power Commission of Ontario have prepared estimates for laying a hydro-electric railway line from London to Tilsonburg, passing through Belmont, Lyons, Aylmer, Springfield and Brownsville. Estimated cost $892,000. Mr. W. W. Pope, Continental Life Building, Toronto, is the secretary.

Montreal, Que.
Large orders for machinery will be placed at an early date by the A. B. See Electric Elevator Company of Canada, Limited, as part of the equipment of their elevator factory in this city.

Oka, Que.
With the object of supplying Oka Monastery with electric light and of installing up-to-date fire protection, authority has been given to Mr. Fred M. Hoadley, Engineer, Room 802, New Birks Building, Montreal, to make a complete investigation of the possibility of generating power from the river running through the property. The engineer will have investigations completed in about one month, when he will receive catalogues, etc., relating to the work.

Oakville, Ont.
The town council will invite tenders ror the supply of 1,000 ft. of 4-in. and 6-in. pipe for water-works extensions. The laying of this pipe is to be done by day labor. Mr. R. S. Wilson is Superintendent of Water-works.

Grading has been started by the town council in connection with the laying of a concrete pavement and curbs, 50 ft. wide, on Colborne Street. Work is being carried out by day labor. Messrs. R. J. Bell and Chas. Johnston are the engineers. The estimated cost of the work is $18,720.

Messrs. Whittaker Brothers, Dundas Street, contemplate installing an elevator in two-storey garage.

Ottawa, Ont.
A quantity of stable fittings and furnishings will be purchased by the city council. Mr. F. C. Askwith is the engineer.

Simcoe, Ont.
Showrooms are being opened by Messrs. [illegible], who will do business as electrical contractors. The firm will require material for the installation of electric lights and combination fixtures, electric devices, etc.

St. Catharines, Ont.
The Joint Hydro-electric Union of Niagara District will petition the Hydro-electric Power Commission of Ontario for survey of the following new lines:— St. Catharines to Hamilton via Power Glen and Smithville, through the Townships of [illegible] to Niagara Falls through the townships of Thorold and Stamford West.

Toronto, Ont.
The firm of Keiths, Limited, Toronto, have been awarded the contract for switchboard equipment and switchboard platform at the new Central Technical School, Toronto. This is one of the largest switchboard installations in Canada.

The board of control has recommended the carrying out of 42 ft. of grading on Rosewell Avenue, at an estimated cost of $16,278. Mr. R. C. Harris, City Hall, is Commissioner of Works.

Winnipeg, Man.
Tenders are in for heating and plumbing in connection with $150,000 Power House in course of construction on Broadway for Provincial Government Department of Public Works. The contract has not yet been awarded. The National Construction Company, Winnipeg, are the general contractors. Mr. V. W. Horwood, 261 Fort Street, is Provincial Architect.

Miscellaneous

Daysland, Alta.
The Berrard Grain Company have decided to rebuild elevator recently destroyed by fire. Estimated cost of work $7,500.

Quebec, Que.
Tenders will be received by Mr. A. Malouin, Secretary, Fire Committee, City Council, until January 5, for the supply of 2,000 feet of rubber-lined fire hose in fifty lengths, with couplings.

Toronto, Ont.
The Toronto Harbor Commission is considering a number of inquiries from United States firms seeking building sites in the industrial section of the Commission's water front development.

The Morris Machine Works, of Baldwinsville, N.Y. (of which the Storey Pump & Equipment Company, Toronto, Ont., are the Canadian selling agents), are supplying a twenty-inch hydraulic dredging pump for use on the new Welland Ship Canal.

The Storey Pump & Equipment Company, Toronto, are supplying two "Morris" double suction centrifugal pumps with Kerr Steam Turbines, for forced hot water circulation work in the new Sun Life Insurance Building, Montreal.

Victoria, B.C.
The Fire Committee of the city council has recommended that a fire alarm system to cost $10,000 be installed. Mr. W. J. Dowler is city clerk.

The Provincial Government has temporarily discontinued work at Strathcona Park.

Winnipeg, Man.
Sealed tenders, addressed to Mr. S. H. Reynolds, Chairman of Commissioners, Greater Winnipeg Water District, will be received up to noon of Monday, January 18th, 1915, for the supply of gravel pit excavation, screening, crushing machinery, etc. Also for locomotive and cars for pit and for railway service. Specifications and form of tender may be obtained and form of contract inspected at the office of the District.

West Fairbank, Ont.
The West Fairbank Ratepayers' Association has passed a resolution requesting that York Township's council get authority from the legislature to issue $1,000,000 worth of bonds for the purpose of providing work, including grading roads, putting down sidewalks, constructing sewers, laying water mains and doing other necessary improvements.

CONTRACTS AWARDED

St. John, N.B.
The Turnbull Elevator Manufacturing Company, Toronto, has been awarded the contract by the Dominion Government Department of Public Works to supply and install one passenger and one freight elevator, also one electric ash hoist, in post office building at St. John.

Sarnia, Ont.
The H. Mueller Manufacturing Company has been awarded a contract by the Dominion Government for the manufacture of 50,000 brass parts to be used in the construction of shrapnel shells.

Toronto, Ont.
The contract has been awarded to the Page-Hersey Company, Limited, Toronto, for the supply of 32 28-ft. poles, 40 30-ft. poles and 24 30-ft. steel poles (lighter) the price being $1,547.

Vancouver, B.C.
The Dominion Ornamental Iron Company has received the contract for the erection of an iron rail fence around Beaconsfield School Building at $1.48 per lin. ft.

New Companies

The Leach Concrete Company, Limited, Toronto, has assigned to Mr. Jas. P. Langley. The Company was a large contracting concern with offices at 76-78 Albert Street, Toronto.

Messrs. Robert J. D. Smith and Alfred J. Mallett, of Prince Rupert, B.C., who carried on business as plumbers and heating engineers under the firm name of Smith & Mallett, have mutually dissolved partnership. In future the business will be carried on by Mr. Robert J. D. Smith.

International Lime Company, Limited, has been incorporated with head office at Montreal, to carry on business as manufacturers of and dealers in lime, plastering and also all builders' supplies. The capital of the company is $200,000 and the incorporators include: William Kenneth McKeown and Henri Lacerte, advocates, both of Montreal.

Tenders and For Sale Department

Tenders for Construction of Sewer

Sealed tenders plainly marked as to contents, [illegible] to noon [illegible] Monday, December 28, 1914, for the construction [illegible] Avenue, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto. The [illegible] accepted

FRANK BARBER,
Township Engineer.

Toronto, Dec. 18, 1914. 51

Greater Winnipeg Water District

Tenders for Equipment

Sealed tenders addressed to the undersigned will be received up to noon of **Monday, January 18th, 1915**, for the supply of gravel pit Excavation, Screening, Elevating and Crushing Machinery. Also for Locomotives and Cars for pit and for railway service.

Specifications and form of tender may be obtained and form of contract may be inspected at the offices of the District.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners.

Winnipeg, Man.,
901 Boyd Building,
December 14th, 1914. 51-52

AGENTS WANTED

Large firm making a complete line of concrete machinery and gasoline engines, trucks and barrows, wants sales agents for Ontario and Quebec. Now successfully represented in the West. Box 121, Contract Record, Toronto, Ont. 51-2

AGENTS WANTED

One of the largest firms on the Continent making motor trucks, wants sales agents for whole or part of Canada. Putting out a truck which represents one of the most important advances in truck manufacture. It drives from all four wheels and likewise steers and brakes on all four wheels. Company very strong financially. Box 120, Contract Record, Toronto, Ont. 51-1

AGENTS WANTED

Large United States firm manufacturing steel wheels, farm trucks, handy wagons, logging and traction wagons, dump carts, engine carts, etc., [illegible] Canada. Write stating what territory you can cover. Box 119, Contract Record, Toronto, Ont. 51-1

AGENTS WANTED

If you are absolutely responsible and are interested in selling a successful, high-grade line [illegible] by a firm long established, let us know at once. We are now making new contracts for 1915 and need a few reliable dealers and agents in unoccupied territories. References required from parties not rated. Address, Box 118, Contract Record & Engineering Review, Toronto, Ont. 51-3

Late News Items

Elora, Ont.

The Krausman Hotel, Metcalfe Street, has been totally destroyed by fire.

Galt, Ont.

Tenders are open for the supply of interior fittings for $45,000 armoury. No date has been set for the closing of tenders. Mr. R. C. Desrochers, Ottawa, is Secretary, Dominion Government Department of Public Works. Messrs. P. H. Secord & Sons, Toronto Bank Building, are the general contractors.

Hamilton, Ont.

Tenders are being received for electrical work on $8,000 residence in course of construction, 2½-storey, 33 x 40, for Mr. Geo. A. Truman, Driving Park Hotel, Hamilton. Owner will purchase interior fittings.

Matane, Que.

Tenders will be received by Mr. R. C. Desrochers, Ottawa, Secretary Dominion Government Department of Public Works, until 4 p.m. January 5, for interior fittings in post office and customs house, specified thus: oak screens, brass wickets, doors, cornice, shelving, pigeon holes, counters, desks, cupboard and wardrobe, blackboard and three door springs. Plans and specifications are at office of Mr. Jos. Raymond, Clerk of Works, Matane; I. Lacasse, Clerk of Works, Quebec, and at Department, Ottawa. Specification at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Medicine Hat, Alta.

Medicine Hat Planing Mills, Limited, have suffered a loss of $10,000 through the destruction by fire of Stock Room and contents.

Niagara Falls, Ont.

A by-law to authorize the construction by the city council of a sewer in the course of Muddy Run Creek, at an estimated cost of $200,000, will be submitted to the ratepayers in January. Mr. W. J. Seymour is City Clerk. Mr. F. Anderson, City Hall, Engineer.

North Vancouver, B.C.

Pacific Great Eastern Railway, 325 Howe Street, Vancouver, contemplate erecting a steel bridge over Capilano River, near North Vancouver. Mr. John Callaghan is chief engineer.

Vancouver, B.C.

Burrard Inlet Tunnel & Bridge Company, 142 Hastings Street West, have awarded the general contract for erecting steel and concrete bridge, centre span 225 ft., to Canadian Bridge Company, Walkerville, Ont., at $1,846,000. Messrs. Cleveland & Cameron, 1001 Rogers Building, are the engineers. Sir John Wolfe Barry, Lyster and Partners are consulting engineers.

Winnipeg, Man.

Tenders will be received by Mr. S. H. Reynolds, Commissioner, Greater Winnipeg Water District, 901 Boyd Building, until December 28, for the supply and erecting of four 15,000-gal. and one 40,000-gal. wooden water tanks; or the alternative of one 40,000 or 30,000-gal. and four 15,000 or 10,000-gal. steel tanks. Plans and specification are at office of owner.

The new building code adopted by the City Council of Macon, Ga., and which went into effect September 1, provides that all buildings shall be roofed with non-inflammable material.

The Italian Minister of Education will spend $15,440,000 for public school buildings during the four years 1913-1917.

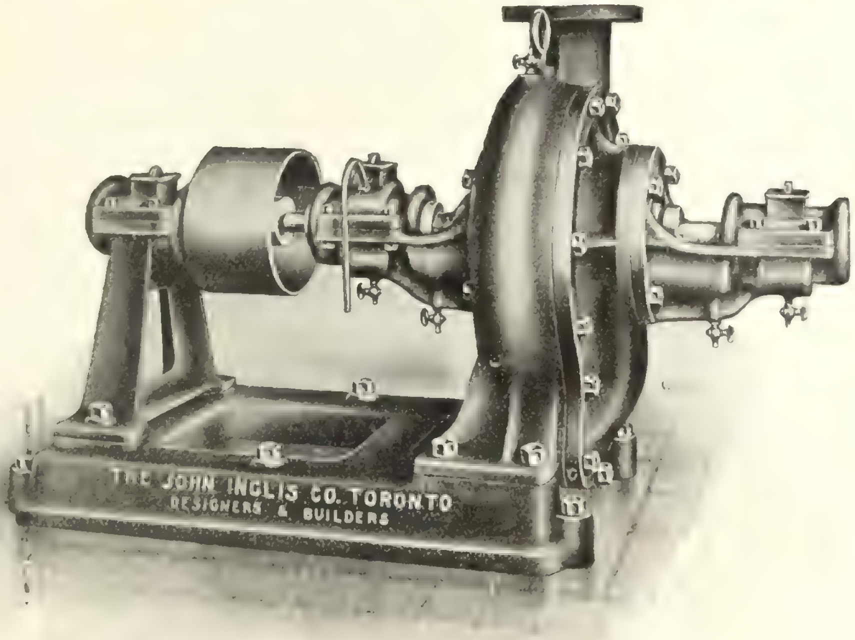
The Edmonton, Dunvegan and British Columbia Railway have under construction at the present time a power house to be equipped with some 250 kw. capacity in electric generators. This power house will be located at their terminal north of the G. T. P. railway track, Edmonton. The boiler equipment consists of two return tubular horizontal units, 150 h.p. each, working at 125 pounds pressure. Two generators of 125 kw. capacity each, direct connected, are expected to be in operation by the first of February, 1915. The output of the plant will be used to light their own terminal and also to operate the machinery in their car repair shop, which is also under construction at this point.

More than twenty concrete piers built several years ago by the Aberthaw Construction Company, and submerged in the United States Navy Yard at Boston, are again being examined to note the action, both mechanical, due to frost, and chemical, due to ingredients in the sea water. As this subject is one which has a large bearing on the permanence of piers, abutments, sea walls, etc., when built of concrete, these experimental tests are expected to yield some very valuable results.

A structure which is said to be unique so far as that city is concerned is a nine-storey reinforced concrete building going up on the outskirts of the business district of Chattanooga, Tenn. What is regarded there as the unique feature is the provision of bachelor apartments on the floors above the main storey which is devoted to banking purposes. There are two-room suites with private baths and ten single rooms each with private bath. The ninth floor has a large sun parlor. The cost is placed at $100,000.

The contract for the wiring and for installing the electrical equipment of the new Customs warehouse, Ottawa, has been awarded to the Canadian Electric Company, Montreal. The current for lighting and power purposes will be supplied from a sub-station at 2200 volts, and stepped down to 440 volts for power and 110-220 for lighting. The company will supply six transformers—3 of 60 kw. and 3 of 75 kw. The switchboard will be 27 feet long. Three elevators and the ventilating, pumping, and heating systems will be electrically operated, direct current being used for the elevators. The motors will be direct connected, and their supply is not included in the contract. All the telephone wires will be in conduit.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

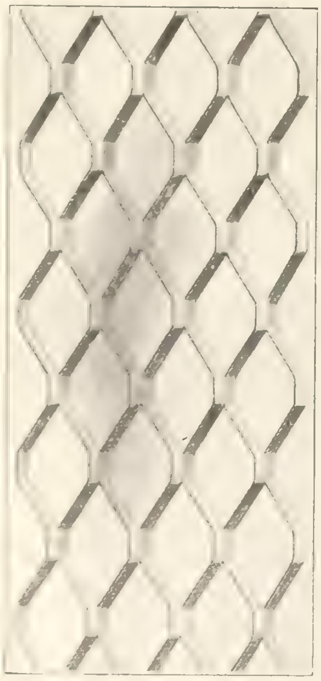
ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Central Y.M.C.A. Building, Toronto.
Fireproofed with Pedlar's "Perfect" Metal Lath.

Modern Construction Demands



Pedlar's "Perfect" Metal Lath

ARCHITECTS are specifying Pedlar's "Perfect" Metal Lath in place of wood in buildings of modern construction. The slight extra cost is more than compensated for by the saving of labor in applying.

Furnished in large sheets, size 96 x 24 inches, ready for use.

Used in conjunction with our "Perfect" Corner Bead, Pedlar's "Perfect" Metal Lath makes a permanent fireproof job, binding the plaster firmly into place, and obviating the the possibility of broken corners.

**Prices and full particulars in our
Lath Booklet, sent free upon request.
Address Branch Nearest You.**

THE PEDLAR PEOPLE, Limited

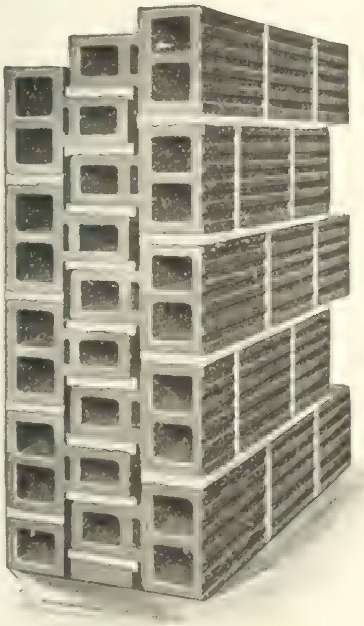
Executive Office and Factories:

OSHAWA, ONT.

MONTREAL OTTAWA TORONTO LONDON WINNIPEG

DENISON

Interlocking Hollow Tile



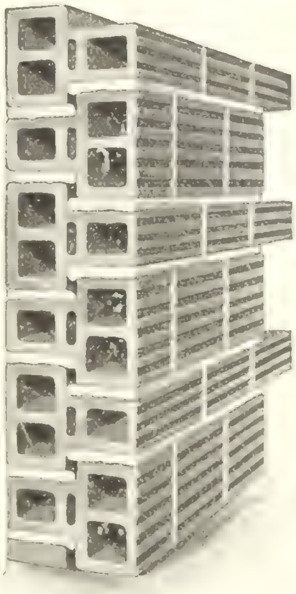
Twelve Inch Wall

The one size and shape builds all thicknesses of walls.

Denison Interlocking Hollow Tile, the modern building material, possesses bonding and interlocking properties unequalled by any other tile.

When Denison Tile is used in wall construction, there are no mortar joints extending through the wall to carry moisture. This feature, together with many dead air spaces, renders the Denison Tile wall impervious to moisture, heat, cold and sound.

Denison Hollow Tile is fireproof.



Eight Inch Wall

Orphanage for I.O.O.F. BUILT LIKE A THERMOS BOTTLE Oakville, Ont.

Architect—Geo. N. Molesworth Gen. Contractor—Sutherland Construction Co.

SUN BRICK COMPANY, LIMITED

The One Price Company

Traders Bank Building

TORONTO, ONTARIO

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; with bags $2.25, car lots, $1.55 on the track, with bags $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $[illegible].50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $55 per M. Lots over 100,000, $50.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $[illegible] to $[illegible] per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 54c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 66c. per Imp. gal. southern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.45, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 66)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY LIMITED

BAR STEEL

Warehouse Stocks:
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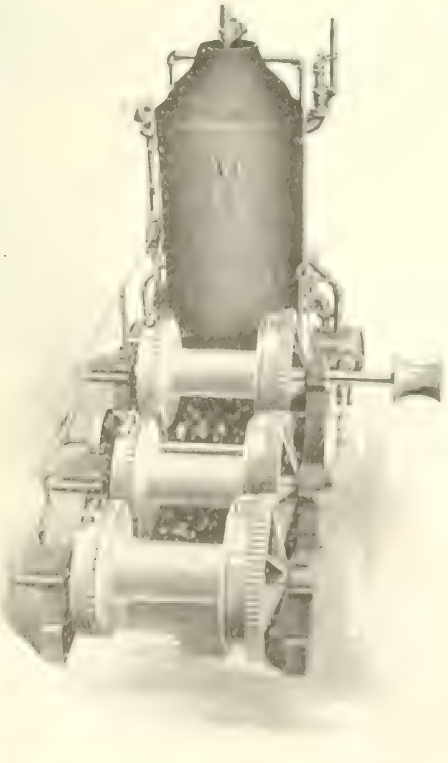

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Canadian Contractors!

Canada Needs Your Business

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Hoisting—Material Handling—Excavating Equipment

Has always been Made in Canada

Hoisting Engines—Clamshell Buckets—Steel Derricks—Timber Derrick Fittings — Centrifugal Pumps

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We are in fine shape this Winter to take care of your repair work. Our large stock of patterns, our years of experience, our engineering and manufacturing facilities enable us to handle repair jobs on Dredges and other equipment at minimum cost to you.

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The 13160 is the best all round valve with the widest range of service.

No. 13160

The Mueller line of reducing and regulating valves includes a valve for every pressure. No matter what kind of pressure you are working with—steam, air, oil, gas, or water—we have a valve which will not only meet your requirements but will give you absolutely perfect service.

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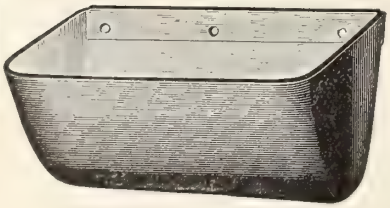
Makers of high grade Water, Plumbing and Gas Brass Goods.

We Specialize in

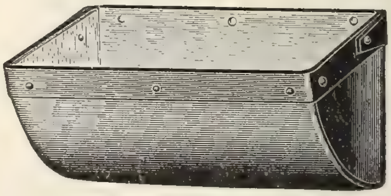
STEEL ELEVATOR BUCKETS

For all kinds of work

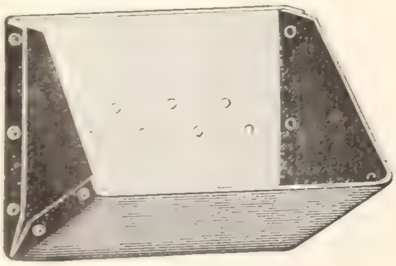
Buffalo Elevator Bucket



Salem Elevator Bucket



Empire Elevator Bucket



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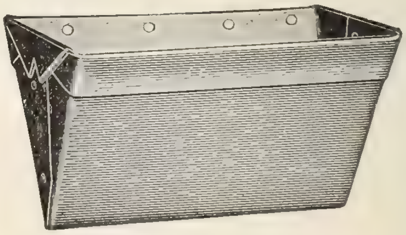

V Shape Elevator Bucket

John Radigan & Company, Hamilton, Canada

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Everlasting
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The
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"Made in Canada" Concrete Brick

At last it is possible to obtain a brick that is really everlasting. Our "Made in Canada" concrete bricks are made in a large variety of colors. They are solid concrete, perfect in shape and each color is uniform. These bricks are waterproof, fireproof and harden with age.

The building illustrated is faced on all sides with grey concrete brick, trimmed with red.

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Burlington Steel Co.
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for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares, Angles, Channels, T-Bars, Ovals, Half Ovals, Half Rounds, Bands, Special Sections.

CROSS ARM BRACES POLE SHIMS
Plain and Galvanized

Prompt Shipment from Stock

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

Continued from page 62

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls., 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25-lb. tins, $3.35; turpentine, in bbls., 75 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 13c. per ft.; 6-in. 25c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in., 40c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in., $1.50 ft.; 24-in., $2.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

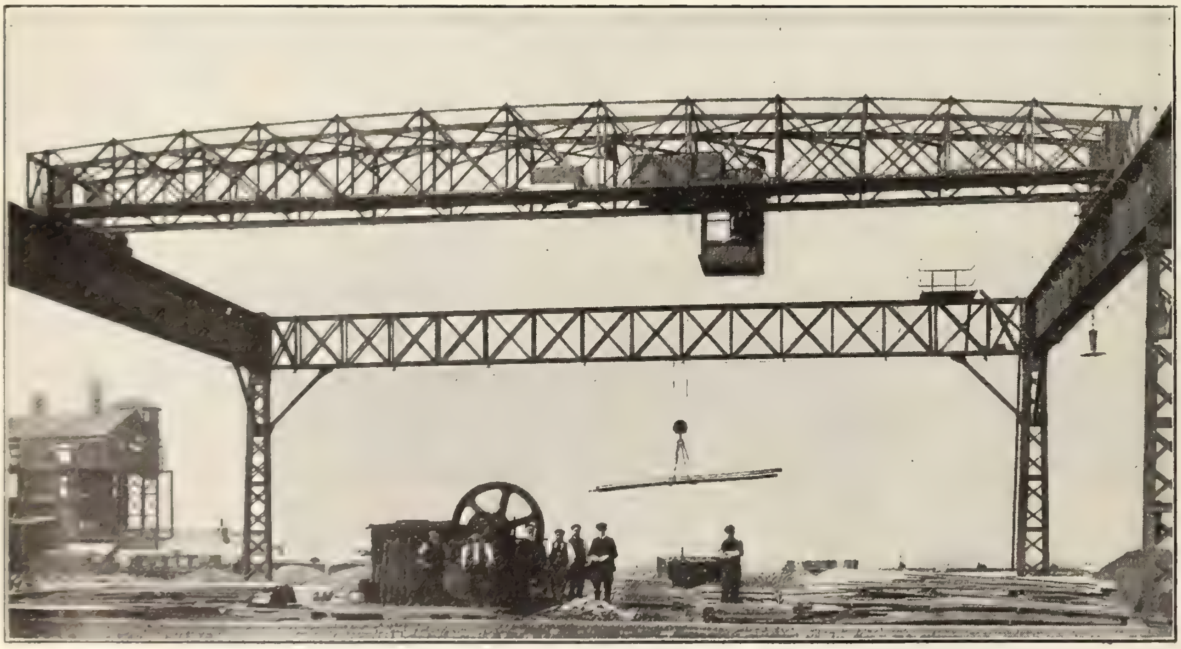
PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 82c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 80c. per gal.; red lead, dry, $8.00 to $9.50 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.



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Towers and Tanks for all purposes.

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Water supply outfits of every description.
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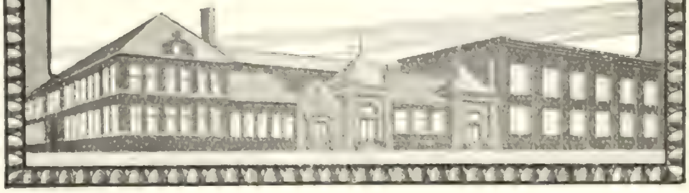

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Do your part—keep your money "at home"

Now of all times the suggestion of using only Canadian-made building materials should have double force. Keep the "Metallic" catalogues beside you and correspond with us—you'll find we meet your every need promptly and economically with goods that are CANADIAN OR BRITISH MADE THROUGH AND THROUGH.

The "Metallic" line includes "Eastlake" Steel Shingles; "Empire" Corrugated Iron; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fire-proof Doors and Windows; Well Curbing; Culverts; Conductor pipe and Eave-troughs.

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Metallic Roofing Co., Ltd.
Manufacturers—Toronto & Winnipeg

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Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lbs. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed complete.

WATER TANKS
all sizes.

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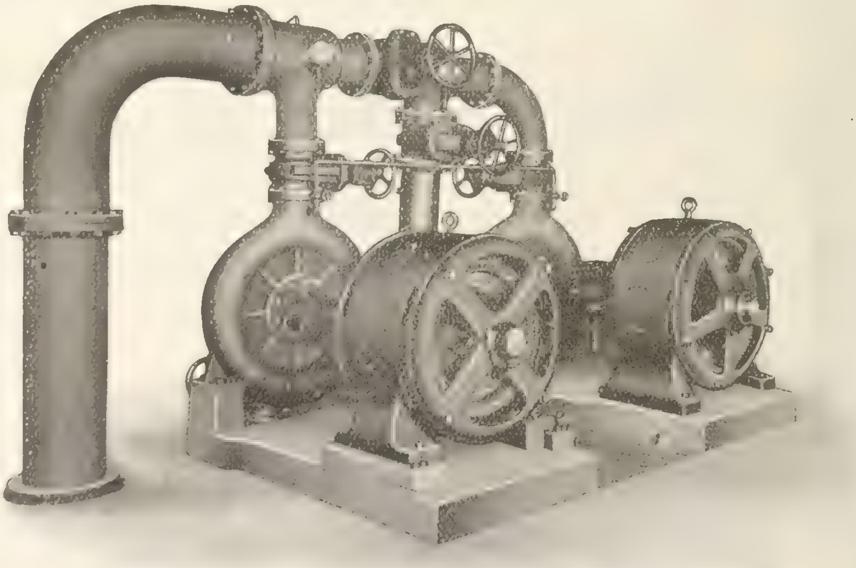
Turbine Pumps

Electric and Steam

Water Works Factory and Fire Services

Humphrey Gas Pumps

Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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Manufacturers of Boilers, Castings, Condensers, Elevators, Engines, Filters, Forgings, Hydraulic Machinery, Pumps, centrifugal and reciprocating, Steam Turbines, Tanks, Water Wheels, Water Works Plants.

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CONTRACTORS!

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REPAIRING - DONE - NOW

Large Stock Finished Parts Large Assortment Patterns Prompt Service

Standard Hoisting Engines and Derrick Irons – In Stock

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should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

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Good public lighting is a great asset to any town or city as it contributes directly to its growth and prosperity.

We make a specialty of this business, and are in a position to supply you with attractive designs at interesting prices.

Write our lighting pole department for full information.

William Hamilton Company
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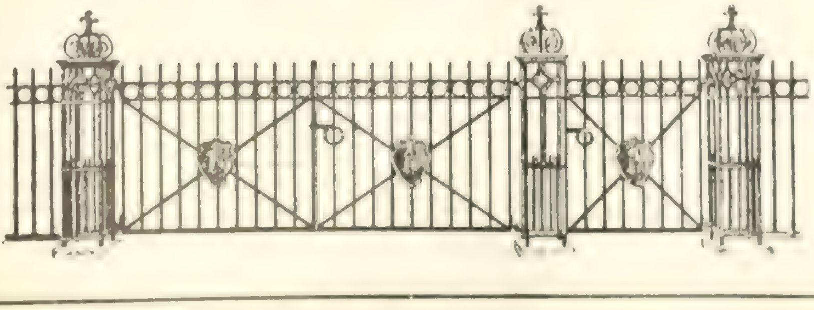

If you have any special designs, monogram sketch of particular work in ornamental iron, you can depend upon us to faithfully fashion your designs.

Prices and Particulars cheerfully furnished

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Anchor Hardwall Plaster

Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

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WE CAN SUPPLY YOU WITH EVERYTHING THAT GOES INTO YOUR BUILDING, EXCEPT THE IRON AND LUMBER

Toronto Agents for

OWEN SOUND CRUSHED STONE
Deliveries—G.T.R. and C.P.R.

Special Attention to Sand and Gravel Orders

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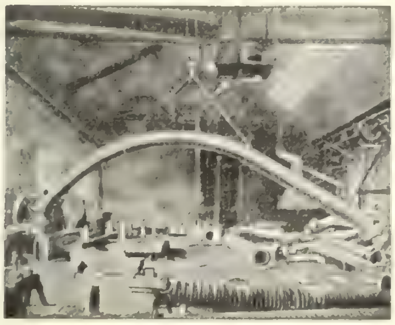

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eliminate heavy fittings
economize space,
avoid leaky joints,
save trouble, room and money

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Drifting Sand Filters

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Designs and estimates furnished on application.

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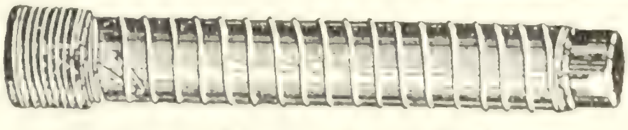

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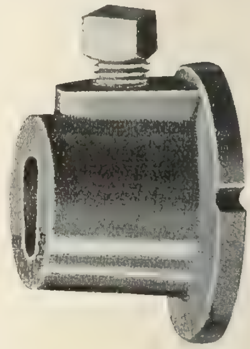

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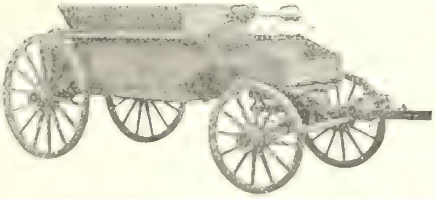

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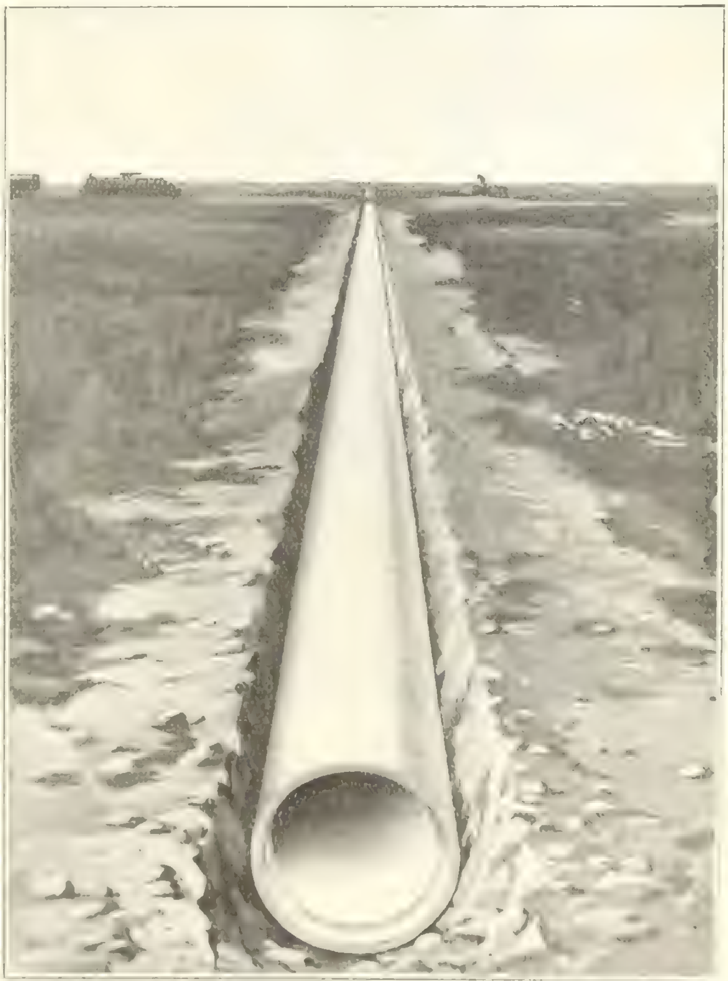

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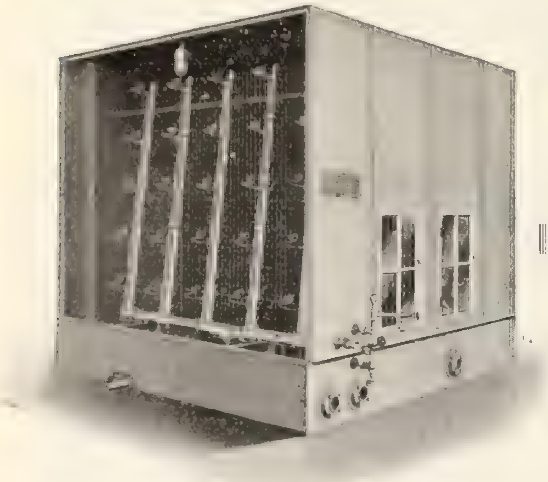

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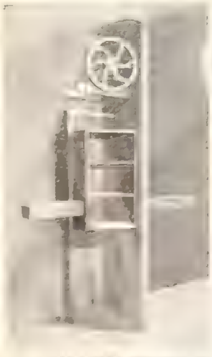

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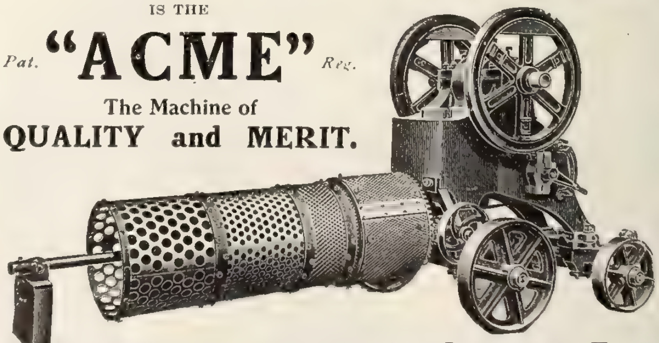

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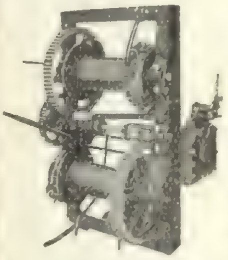

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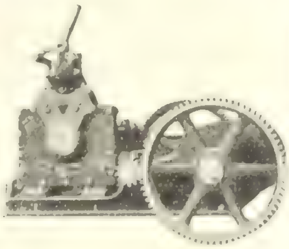

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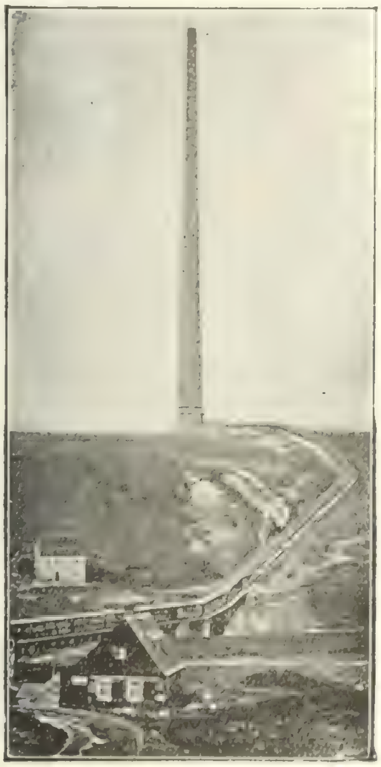

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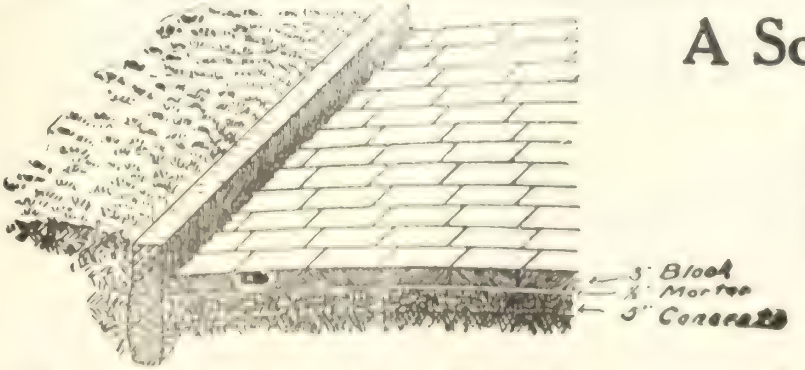

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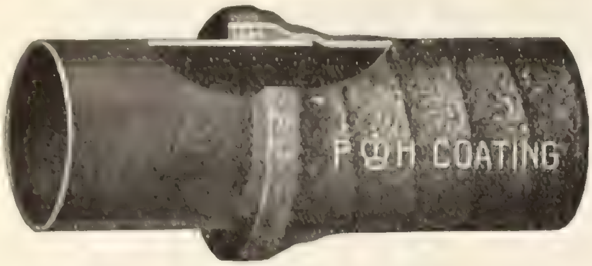

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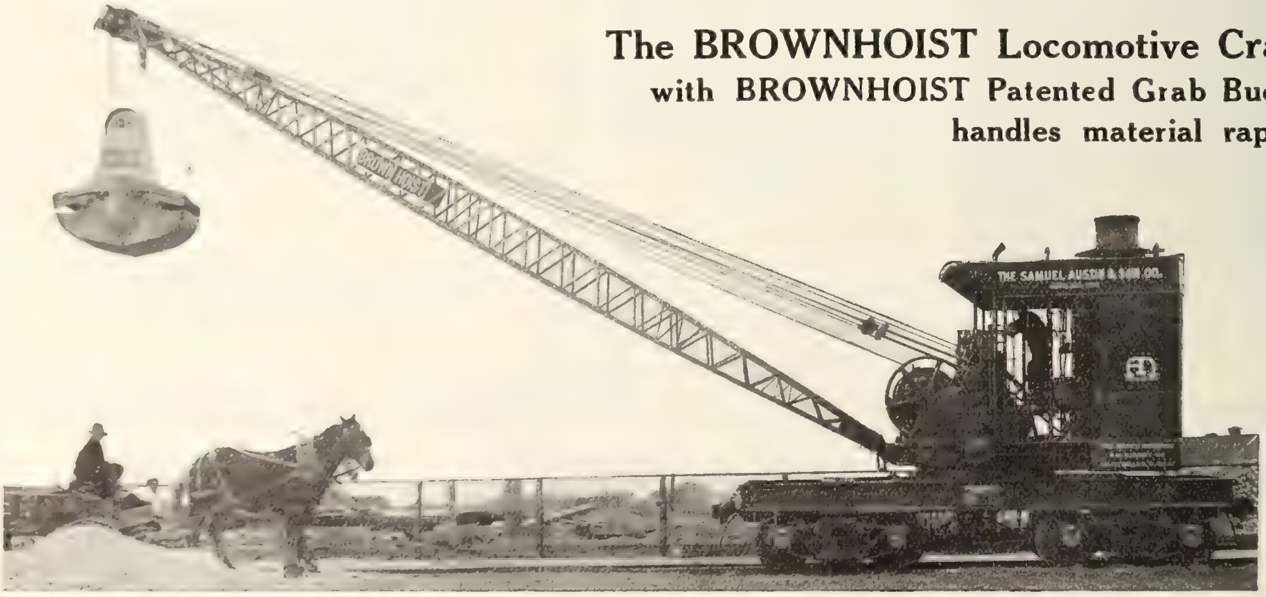

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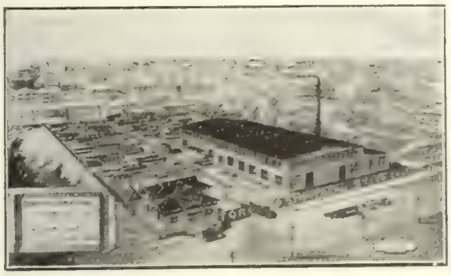

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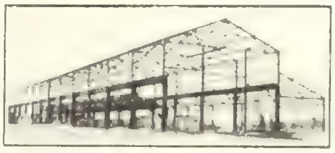

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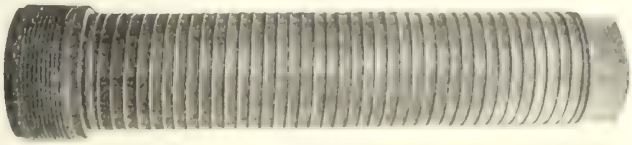

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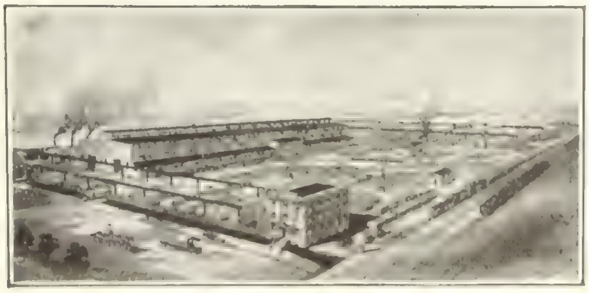

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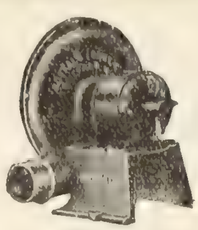

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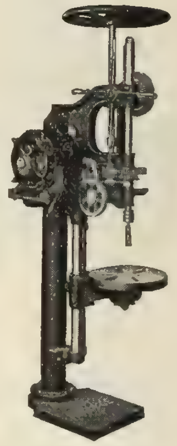

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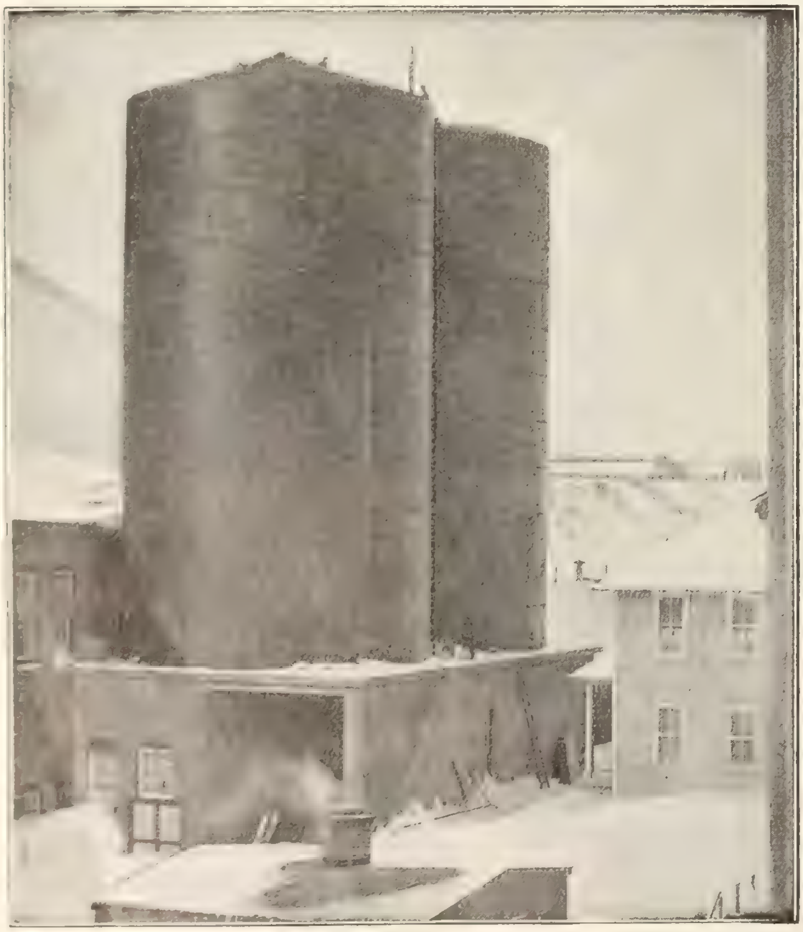

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Oil Refineries, Etc.

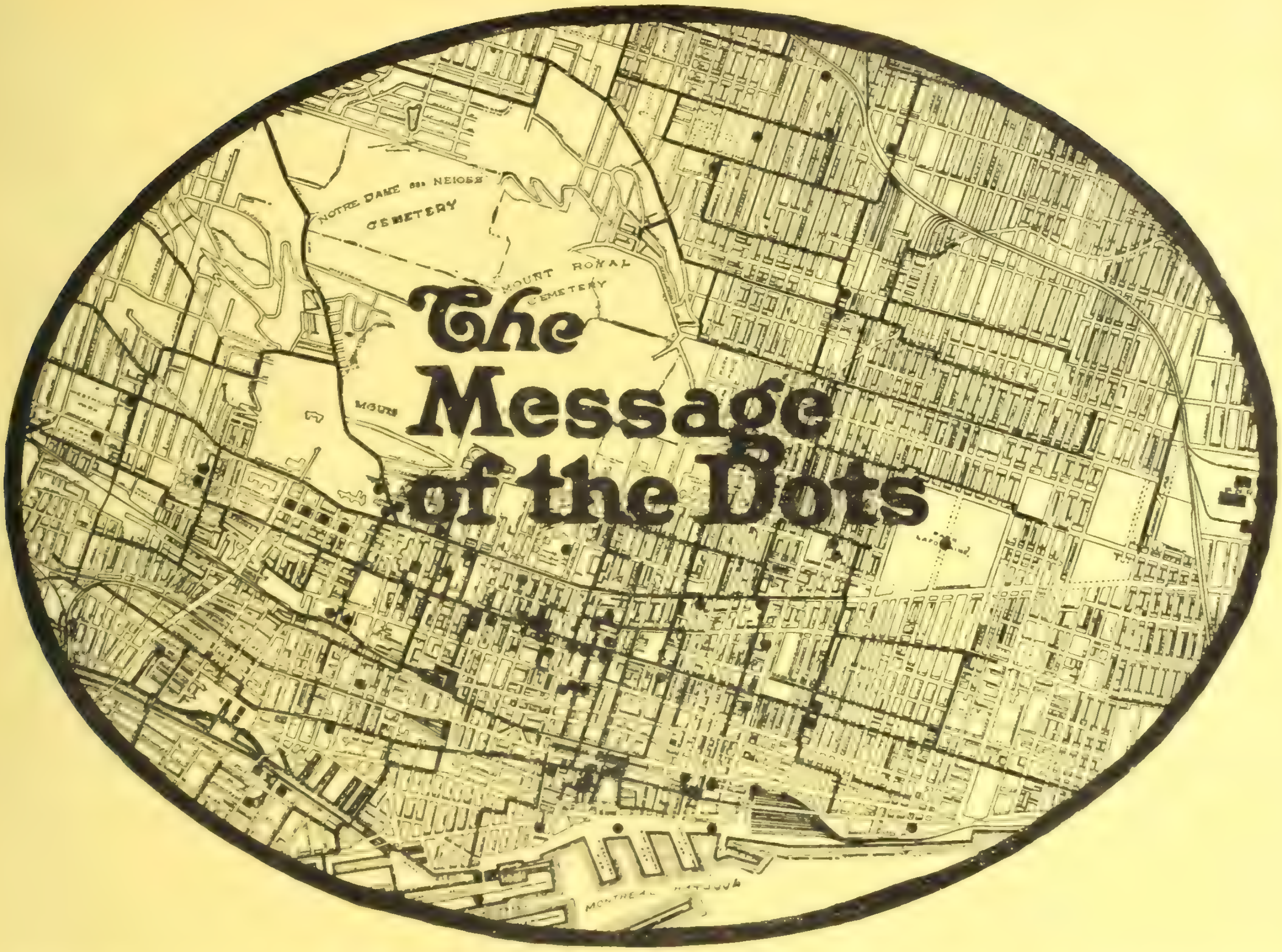
We also build

Steel Structures

to support them.

Write us for quotations

MacKinnon, Holmes
& Company Limited
SHERBROOKE, QUE.



The Message of the Dots

THE above plan shows the central portion of the City of Montreal. ¶ Black dots represent locations of important buildings wired with Northern Electric "ADANAC" or "HIGRADE" wire. ¶ The heavy black lines indicate the Montreal underground system of the Bell Telephone Company of Canada, in all of which is used Northern Electric Lead-covered Telephone Cable. ¶ The dots shown do not by any means represent all of the Northern Electric installations, as enormous quantities of our wire have been sold to contractors for buildings we have not indicated here. ¶ Some of the important installations are as follows:—

Transportation Building
Dominion Express Building
Bank of B.N.A. (Head Office)
Ritz Carlton Hotel
Birks Building
Royal Trust Company Building
McGill University—
  Medical and Engineering Bldgs.
Syndicate Building
Art Gallery
Harbor Elevators, Nos. 1 and 2
G.T.R. Elevator, Windmill Point
Canadian Rubber Company
Canadian Vickers Limited
C.P.R.—
  Windsor Station and Train Sheds
  Place Viger Hotel and Station
Canada Cement Co.
Scroggie Building
Jacobs Building
Goodwins Limited
Imperial Theatre
Princess Theatre
Lindsay Building
Post Office—
  Head Office, St. James St.
  Two Uptown Offices
City Hall and Annex
Frontenac Breweries
Ford Motor Company
All Bell Telephone Exchanges
Bordeaux Jail
Grey Nunnery, St. Laurent
Sommer Building
Westmount High School
United Shoe Machinery Co.
St. Lawrence Sugar Refinery
Canadian Sugar Refinery
Belding, Paul Corticelli Co.
Dominion Box Co.
Reford Building
St. George's R.C. Church
Park Lafontaine
C.P.R. Angus Shops
G.T.R. Point St. Charles Shops
Montreal City Filtration Plant
Montreal Water & Power Co.
Dominion Glass Company
Alaska Feather and Down Co.
W. V. Dawson, St. Urbain St.

As well as many of the largest Apartment Houses in the City

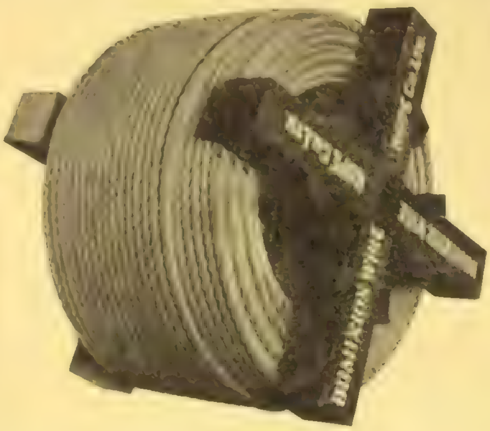
RUBBER COVERED TRADE ADANAC MARK WIRES AND CABLES

THE POINT SEEMS OBVIOUS!

RUBBER COVERED TRADE HIGRADE MARK WIRES AND CABLES

Northern Electric Company
LIMITED

HALIFAX MONTREAL TORONTO WINNIPEG REGINA CALGARY
EDMONTON VANCOUVER VICTORIA



"DOMINION WIRE ROPE"

MADE IN CANADA

We Know Our Ropes are Good—But Our Customers Say They Are The "Best"

Stocks Carried In
Montreal, Winnipeg and St. Catharines

The DOMINION WIRE ROPE CO., Limited, Montreal

"MARION"

Scraper-Bucket Excavators

Built with Bucket Capacities Ranging from ¾ to 6 cubic yards and Booms 40 to 115 ft. in length.

At present used in Canada on the Welland Canal and Halifax Harbor Work

Railroad and Revolving Steam Shovels, Dredges, Railroad Ditchers, Log Loaders, Ballast Unloaders and all kinds of Railway, Contractors' and Mining Supplies.

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B. C.

This Issue Contains Classified Index of Editorial Contents for 1914

ESTABLISHED 1886

Contract Record and Engineering Review

BELLISS & MORCOM, LTD.

Engines and Air Compressors

Over 150 Sets Installed in Canada

Laurie & Lamb
Sole Agents for Canada for

R. HORNSBY & SONS
Gas and Oil Engines

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Road Sweepers

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"FRAM" Electric Wagons

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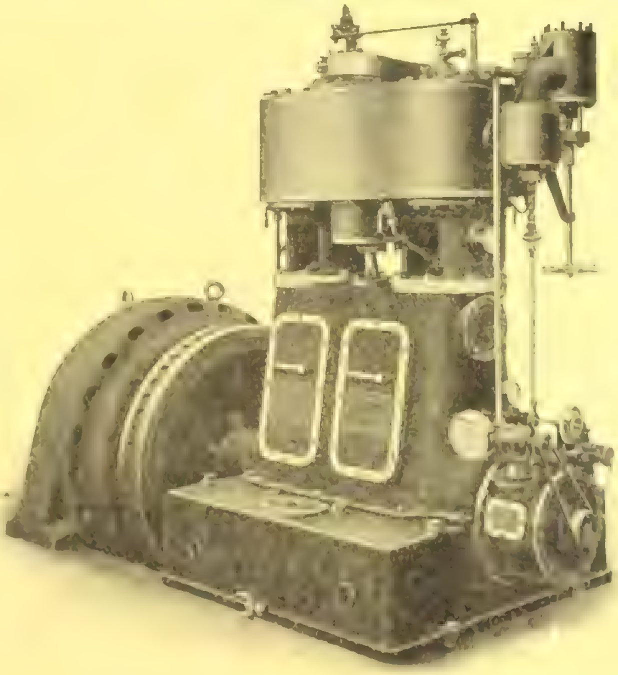


570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

Vol. 28 Toronto, December 30, 1914 No. 52

Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

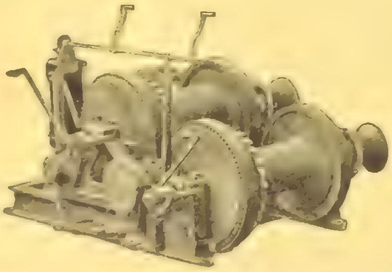
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

"American" Electric Hoists



do electrically the same high-grade work "American" Engines do by steam. They have the regular "American" Frictions; powerful, easy to operate, cool running—can be adjusted to offset wear.

There is an "American" Electric Hoist to meet every hoisting requirement—heavy or light, fast or slow. They are made with from one to three drums. Load is under absolute control at all times and can be locked at any point.

Motors are heavy type, variable speed and are capable of taking large overloads for short periods. The "American" Roller Ratchet prevents the load from dropping should the current suddenly fail.

American Hoist & Derrick Co
St Paul Minn.

Sold by
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Vancouver, B. C.

Stuart Machinery Co., Winnipeg, Man.
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28 "Service" Branches
Throughout Canada

**Canadian Consolidated
Rubber Company, Limited**

Montreal, P. Q.

A New Year's Resolution For You

"RESOLVED that, during 1915 and thereafter I will give preference, in my purchases of rubber goods and all other material, to such as are made in Canada."

So far as rubber goods are concerned you run no risk in making this patriotic resolution, as we manufacture a complete line and the price, quality and style are right.

When in the market for tires, hose, belting, packing, etc., let us show you what we can do.

It is our desire to serve you.

**Canadian Consolidated
Rubber Company, Limited**

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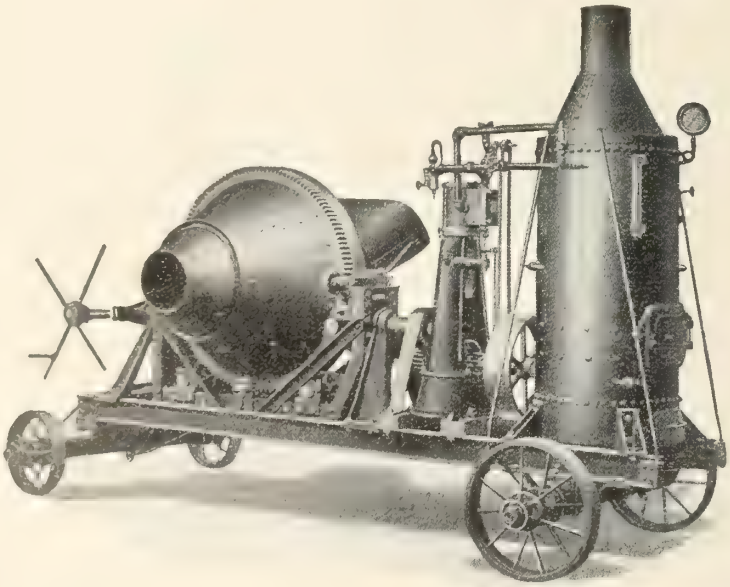
Throughout Canada

Smith Mixers

Never Fail

They turn out a perfect mix. The alternating mixing movement of material is more complete and thorough than any other, the material being mixed from end to end and from top to bottom simultaneously.



The design of the SMITH is mechanically correct and practically no repairs are required.

Ask any user of a SMITH what he thinks of it.

Made in Canada

Mussens Limited

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CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

Not a Talking Point But a Fact

Latest Improvement on the

Holman Tappet Rock Drill

Covers the New Valve Features

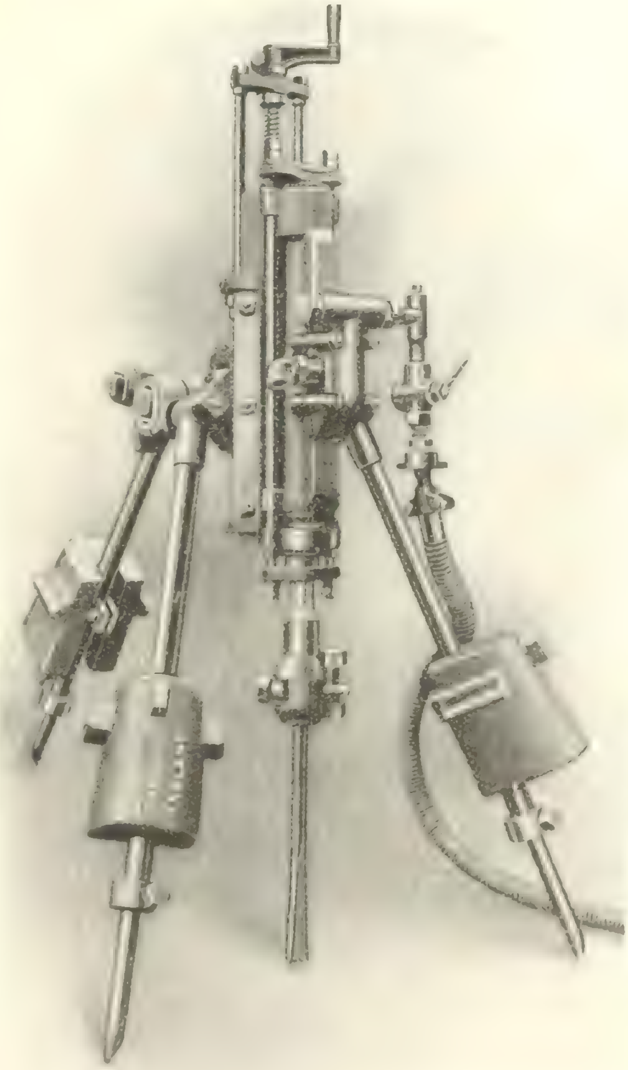
Which make the HOLMAN an absolutely non-freezing machine.

A test made in the Cobalt camp proves this statement.

The HOLMAN fitted with new valve, operating on surface with the thermometer registering 35° below zero, made a continuous run through fourteen shifts without a single stop from freezing, making a record drilling footage under these severe weather conditions.

Install HOLMAN machines and put an end to your freezing troubles.

The Drill You Will Finally Buy.



Write for Catalogue No. 51, to the Sole Canadian Agents

Mussens Limited

MONTREAL 318 St. James Street **TORONTO**, 155 West Richmond St **COBALT**, Opp. Right of Way Mine
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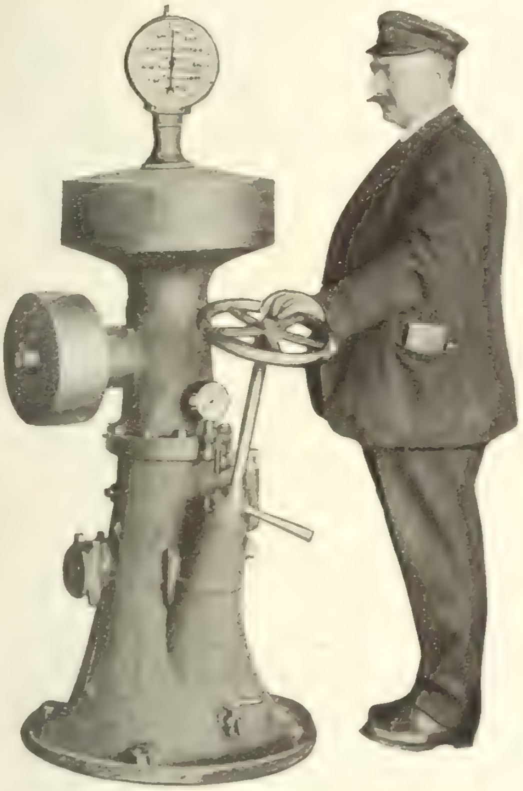
(Continued on page 12)



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Luxfer Means Daylight
Both Literally and Practically

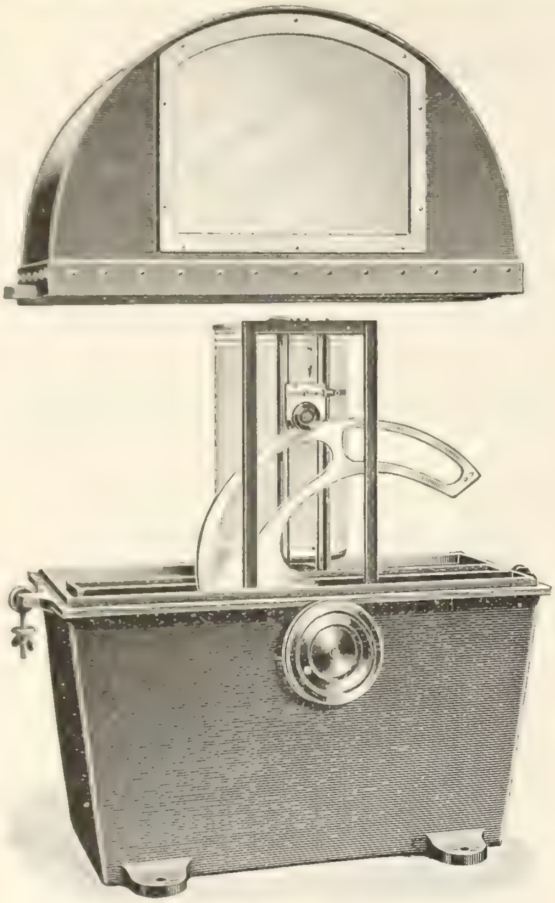
Translate "Luxfer" into simple English and it means to throw daylight.

Install "Luxfer" in any dark building where daylight is wanted and you get daylight thrown where you want lots of it every day and all day long without any cost after the initial outlay.

The Luxfer Prism was the first and best prism on the market and despite its competitors who have come and gone "Luxfer" is still supreme.

Always specify Luxfer and you will always get daylight.

Luxfer Prism Company, Limited
100 King Street West, Toronto



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For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

Send for Book No. 6

which contains fullest information about all classes of Water Level Apparatus.

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Gate Valves

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Fire Hydrants

"MADE IN CANADA"

This Plant is devoted entirely to the manufacture of Valves and Hydrants of approved quality and design.

Now is the Time

to show your patriotism, and prove to yourself and others that KERR valves and hydrants are equal in quality and workmanship, to any made elsewhere.

Break the Habit

of buying foreign made valves and hydrants, and get acquainted with our goods, which you have perhaps imagined were not quite equal to the foreign made article.

Remember

that every dollar spent in Canada for Canadian made goods, is a contribution towards renewal of prosperous times, and the support of Canadian workmen and institutions.

When you spend the dollar with us you get full value in return.

Write for our Catalogue No. 5.

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WALKERVILLE, ONTARIO

NO. "R. I. W." 232

REMEMBER ITS WATERPROOF

DAMP RESISTING PAINT

Bonds Plaster to Brickwork
Saves Cost of Furring and Lathing
Insulates—Checks Dampness
Damp-proofs Foundation Walls

The Best Known and Most Extensively Used Damp-Proofing

MANUFACTURED IN CANADA BY

"R. I. W." DAMP RESISTING PAINT CO.

(Toch Bros. Est. 1848)

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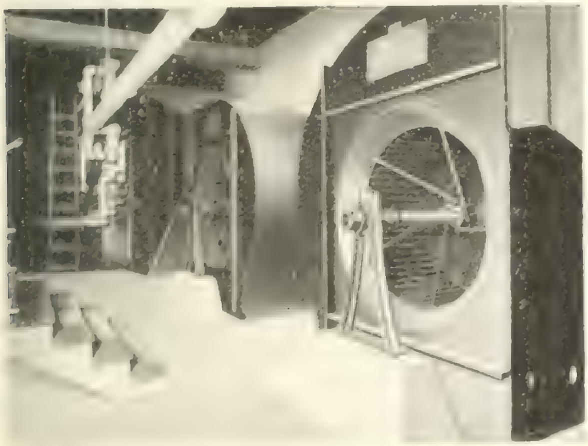
Dartnell, Limited, MONTREAL.
Western Paint Co., WINNIPEG.
Can. Equipment & Supply Co., Limited, CALGARY & EDMONTON



Typical arrangement for School House Heating and Ventilating System

Made in Canada

"Sirocco"

TRADE MARK

Heating and Ventilating Apparatus

By virtue of their many successful performances in Schools—Office Buildings—Factory and Public Buildings; warrant the serious and thorough consideration of every Architect, Engineer and Contractor contemplating the specification or installation of kindred equipment—

Sirocco Systems have so many times done even more than was required of them that the neglect to investigate the possibilities of Sirocco for your requirements would be to waiver the assurance of obtaining equipment of **highest quality—highest efficiency** and **general mechanical superiority.**

Let our Engineering Department tender on your next requirements—Quick service and careful attention is assured inquirers.

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C. T. MORSE [illegible]

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WINDSOR, ONTARIO.

Sales Engineers:
W. P. [illegible]
[illegible]

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Machinery Guards
Window Guards
and
Wire Work of Every Description
Wire Rope
Rope Fittings

Manufactured by

The B. Greening Wire Company, Limited
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HERRINGBONE COPPER ALLOY LATH

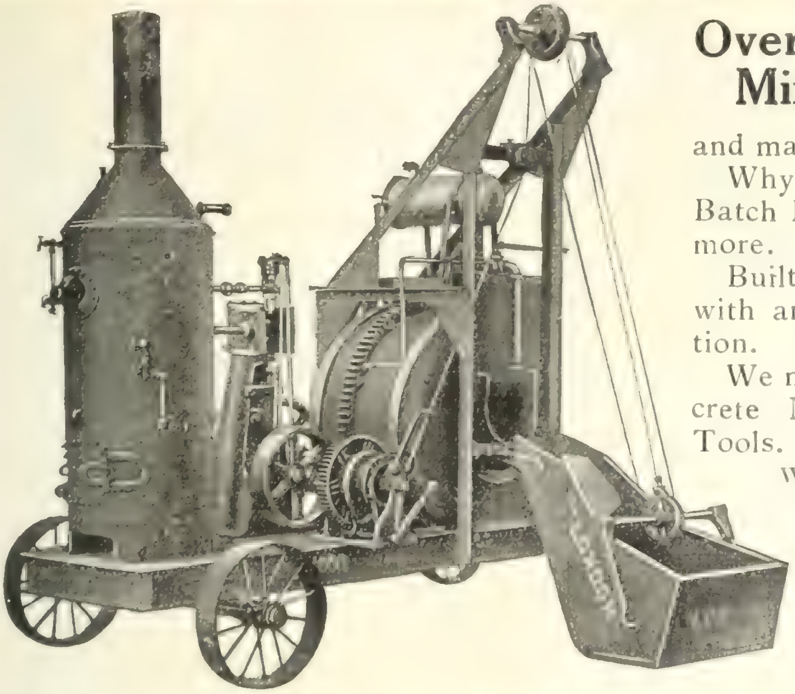
Lime in Hard Wall Plaster

The series of tests which led to the determination that all Herringbone Lath should hereafter be made from copper alloy showed also that there was a wide variation in the rate of corrosion of the different brands of hard wall plaster. When these plasters were arranged in a table in the order of their corrosiveness, the most vigorous at the top, it was found that they were also arranged inversely in the order indicated by their content of hydrated lime, the plaster containing the least lime at the bottom.

That hydrated lime in hard wall plaster retards the corrosion of metal lath cannot be doubted. Fifteen tests on plain steel with a plaster containing no lime showed an average rate of corrosion four and a quarter times as great as that shown by a plaster containing seven per cent. lime. On copper alloy the rates of corrosion were both smaller and the effect of the lime was further increased. The combination of copper alloy and a plaster containing seven per cent. lime showed a rate of corrosion only one-fifteenth as great as that shown by plain steel with unmixed hard wall plaster.

Ask for the booklet "Why Copper Alloy?"

Clarence W. Noble - General Sales Agent
117 Sun Life Building, Toronto
Metal Shingle & Siding Company, Montreal



Over 1200 London Concrete Mixers in Use in Canada

and many in foreign countries.

Why so many? Because every London Batch Mixer in use means the sales often more.

Built in twenty-three different sizes and with any equipment. All steel construction. Built to last a life time.

We manufacture a complete line of Concrete Machinery and Cement Workers' Tools.

We also manufacture:

Cement Tile Machines, Rock Crushers, Mortar Mixers, Concrete Block Machines, Cement Brick Machines, Hoists and Derricks.

We are the Largest Manufacturers of Concrete Machinery in Canada.

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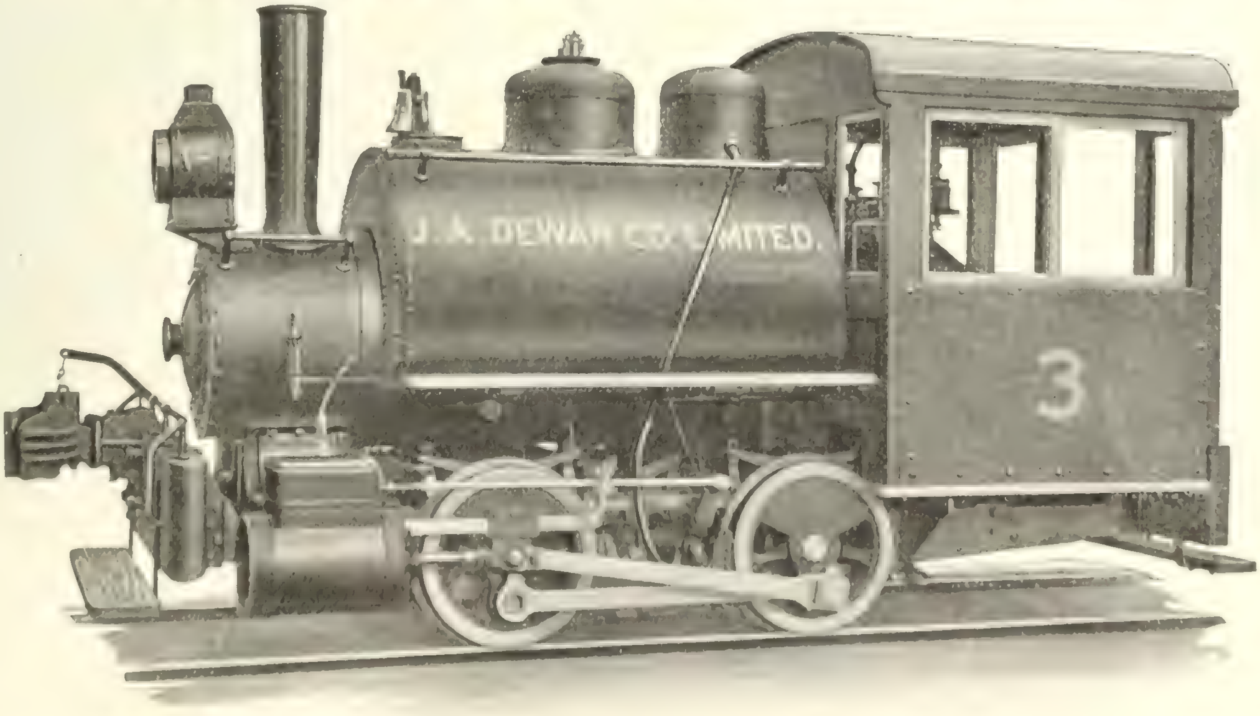
J. A. DEWAR CO. LIMITED.
3

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years' experience at [illegible]. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

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Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

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- Gent & Company

Electric Steel Castings
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"Takes Up Little Room and Fills a Long Felt Want"—

This is an expression from a recent letter handed our Montreal Agents by Messrs. Brown and Vallance, Architects. It is significant of the general opinion of leading Architects throughout the Dominion as to the advantages of

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Raises a maximum load of 500 lbs. at a speed of 30 feet per minute by hand.

Every G & G Telescopic Hoist is subjected to a working test before being shipped.

Does its work economically, safely, quickly.

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When not in use no part shows above sidewalk.

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A superior and economical method for Removing Ashes.

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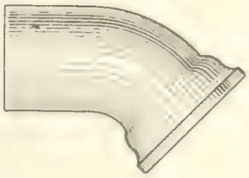

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They're made from specially-rolled, double-refined iron of the finest possible quality for their special requirements. They stand a lot of terrific usage and while they do break and wear out, the book of costs shows that the chain expense of those who use them is lessened after Woodhouse Chains are adopted.

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must be built of a

Tough Stone

that will cement

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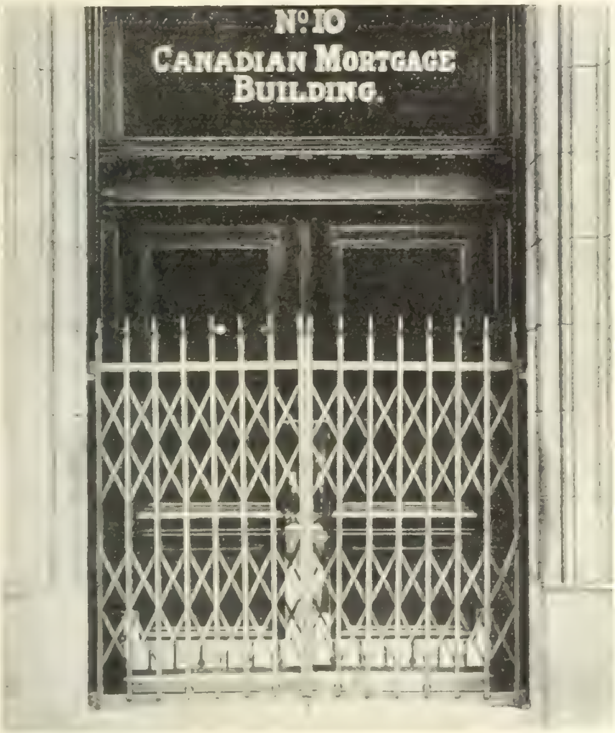

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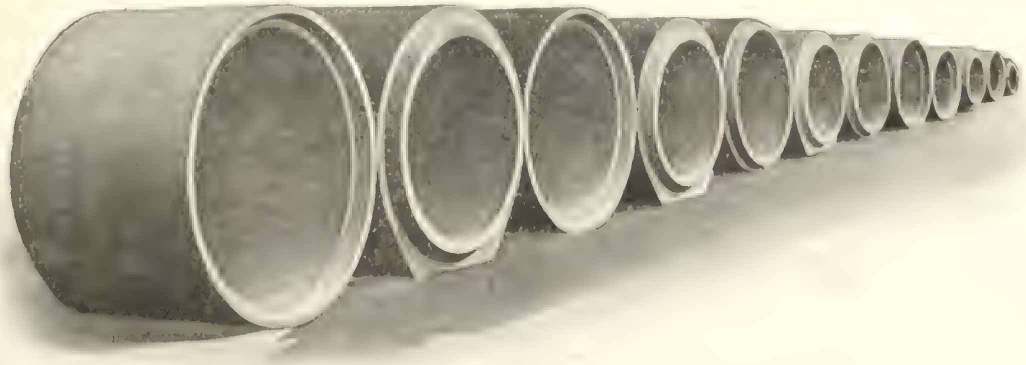

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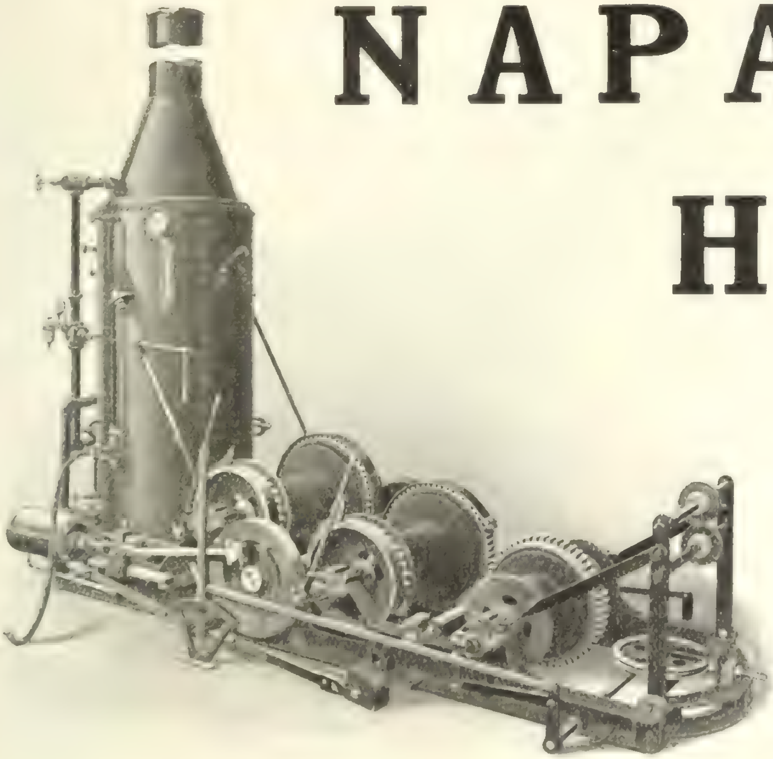

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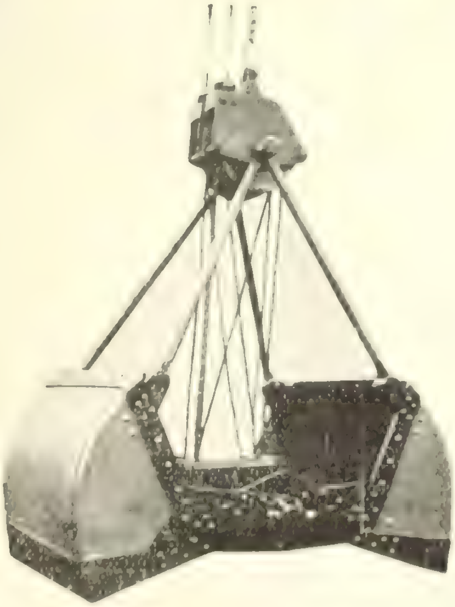

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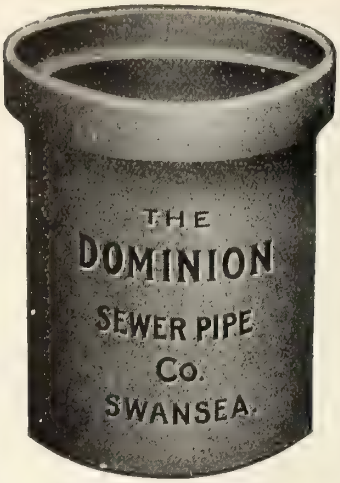

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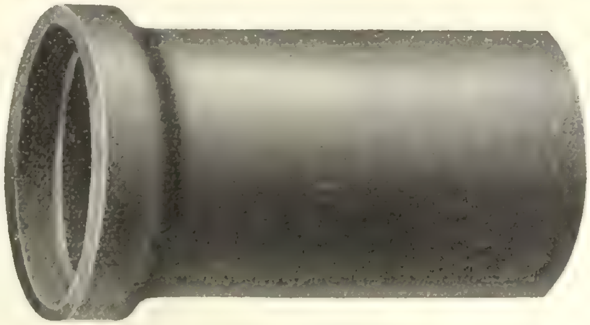

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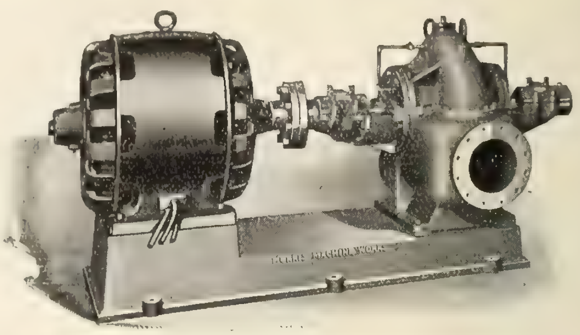

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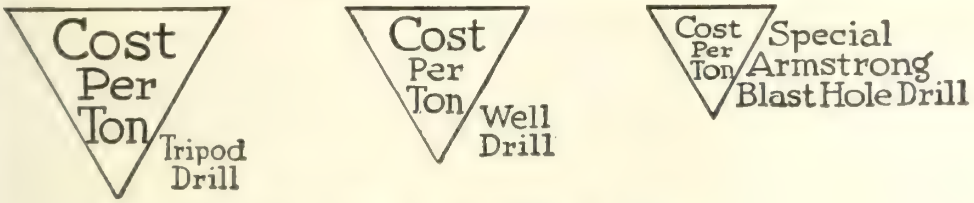

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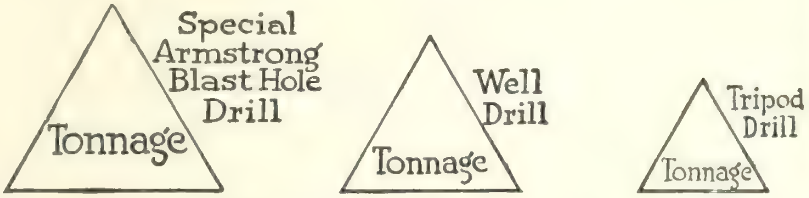

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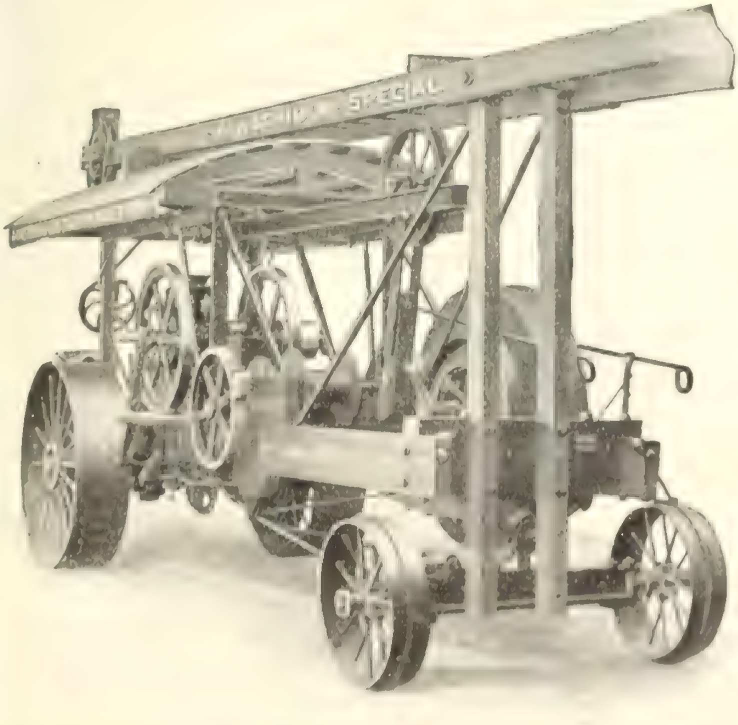

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Delays caused by rain and moving, changing bit, batteries, etc.—19 hr. 22 min.
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[illegible] 100 yd. moving, [illegible] around—4 hr. 40 min.
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Footage drilled per hour—[illegible] counting [illegible].

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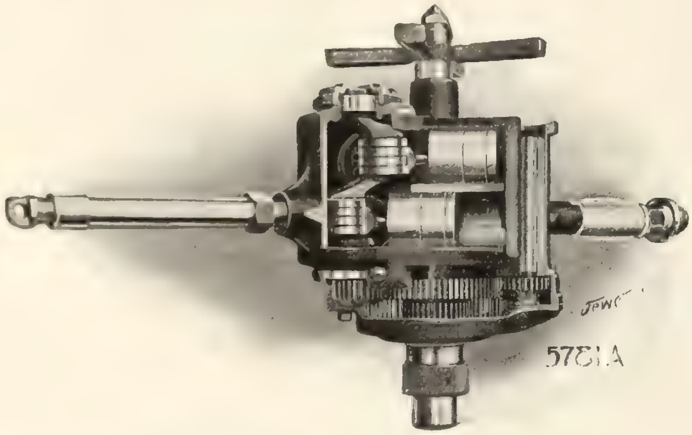

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Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

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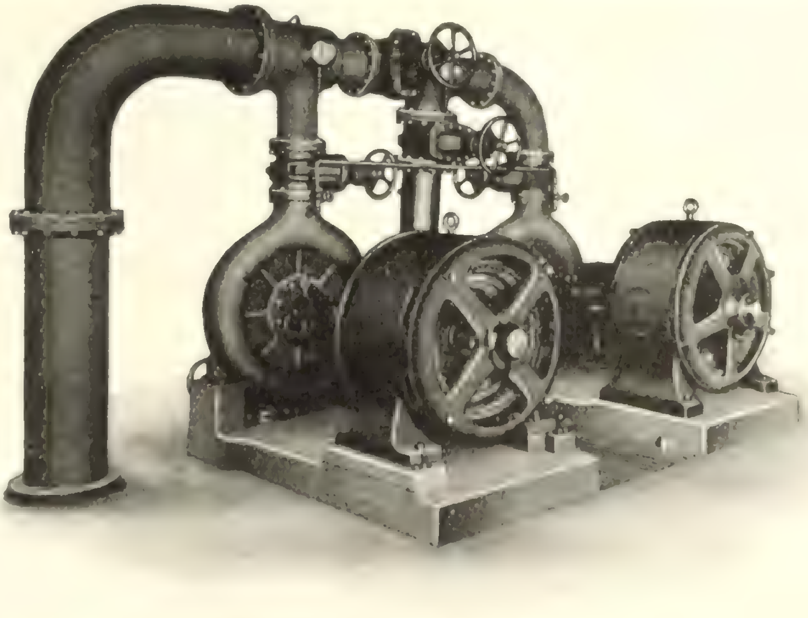

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William Hamilton Company
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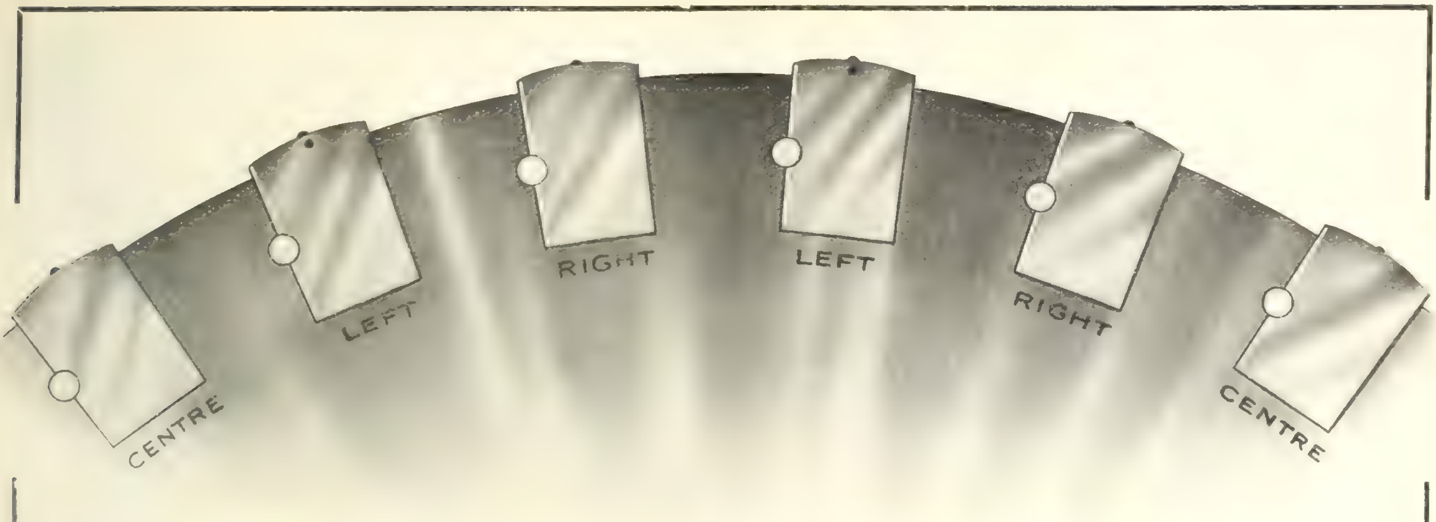

The steel is well worked into the smallest crevices of the diamond, with a welding heat.

By filing the tooth down, thus the diamond will be found to retain its hold to the last shred of steel.

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In recent tests in sandstone (the hardest stone on diamonds) our patent teeth ran eight weeks without the loss of a diamond while competitive teeth in the other blade of the same machine lost 30 diamonds in 8 days. We are prepared to supply to you Anderson's Diamond Teeth at prices varying according to the nature of the stone they are called upon to cut. Our latest achievement (which is a proved success) is that of using up your diamonds to the last shred, heretofore small stones or pieces have been discarded, we make teeth from them at a reasonable figure, eliminating all waste.

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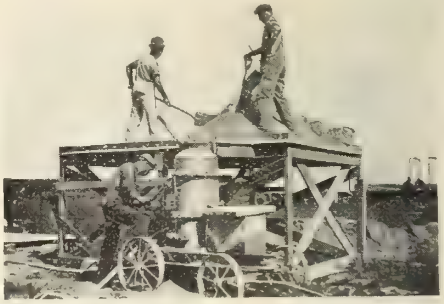
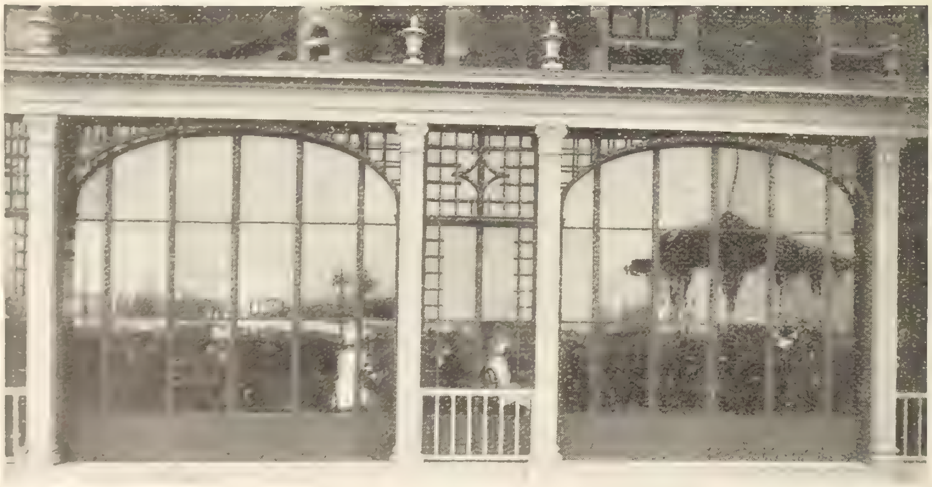

The Cement Gun

Architectural Bronze and Iron



Illustrating ornamental iron and steel folding storm sash, Summer Cafe, Chateau Frontenac, Quebec, facing Dufferin Terrace. Work includes eleven large panels of ninety folding steel doors, twelve small panels and twenty-five columns.

Contract signed April 20th, 1914, ornamental iron furnished and erected complete on June 1st.

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and Engineering Review

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The Old Year and the New

"All things must change
To something new, to something strange."

We are leaving Nineteen Fourteen behind and standing on the threshold of the New Year. To some of us in the constructional world the old year has brought a fair measure of prosperity, to others disappointment. In retrospect we are divided, but in prospect we are one. We have a common interest in the Year of Grace Nineteen Fifteen. We hail it with acclamation because there is every reason to believe that it will be a happier and better year than its predecessor. Nineteen Fourteen has brought wars and rumors of wars, great national trials and financial depression. Nineteen Fifteen must witness improvement. It cannot register further decline.

We have arrived at that stage of combat when the nations are showing reticence in the matter of encouraging the slaughter-house policy of the madman of Europe. The allied armies must go on with their task and reduce to complete submission the most treacherous and menacing foe that the cause of civilization has ever known; but the clamour for war is subsiding, and the task is becoming easier as time goes by and the resources of the enemy become exhausted.

Such considerations as these should give us fresh heart for the business of the coming year.

In inditing the final paragraphs of the editorial chapter of the old year we would impress upon our readers the argument that we have adduced in a number of previous articles, namely, that **we have the strongest reasons in the world for inducing capitalists and financiers to go ahead with constructional projects. Never in our generation will there be a time when more favorable terms can be made with manufacturers, supply dealers and contractors.**

One of the particular reasons for the reduction in the price of building material at the present time is the disposition on the part of the manufacturer and dealer to eliminate profit as far as possible in order to encourage building operations. Only a week or so ago at a meeting of a certain class of manufacturers in Montreal, it was decided to reduce prices almost to cost and extend terms to the limit. This disposition is not peculiar to one class of manufacturer. **In every line of material the supply man is willing to extend terms to encourage constructional projects where the credit standing of the purchaser warrants it.** There have come to our notice cases where firms which formerly insisted upon thirty days are now willing to extend their terms three or four months where they consider the purchasing parties "good risks."

Not only this, but, as we have pointed out before, the labor situation has changed materially and **there is now a surplus of all classes of labor.** Another point is that if real estate prices have not been affected to any great extent by the depressing incidents of the last few months, **lots are certainly available for purchase on better terms.** And generally, the whole constructional fraternity is working together to build up business and provide employment.

A Montreal correspondent of this journal, estimating the effect of these developments, averages the general reduction in building material anywhere from [illegible] to 25 per cent. on the prices obtaining six months ago.

So that with favorable opportunities of entering upon the next constructional season, and with hard facts to back a campaign for a bigger, brighter and better year, we hail the advent of Nineteen Fifteen.

In a sane, well-balanced confidence of the Empire's might and right we are justified in believing that before another twelve months this unjust war will have become only a nightmare of the past, and that Canada, with the rest of the Empire, will have entered upon a period of unexampled prosperity.

This is what the New Year has to offer. And so it is with all sincerity and with complete assurance in the future that we wish our readers a Happy and Prosperous New Year.

Lessons from the Edison Fire

It may be ventured that no occurrence of the kind in recent years has attracted more attention in constructional circles than the fire early this month which destroyed the greater part of the Edison plant at West Orange, N.J.

The fire started early in the evening, in the Film Inspection Building—a one-storey sheet iron structure located in about the centre of the plant. The contents of this building were highly inflammable, and the fire spread rapidly to the adjoining buildings. The principal reasons assigned for the extent of the disaster are interesting in view of the manner in which an examination of the structures showed the small damage sustained by the concrete buildings. The experts employed to make a survey after the fire reported 87½ per cent. of the concrete construction in first-class condition. The damage was attributed to:—(1) the highly inflammable character of the contents of the building; (2) the inadequacy of the water supply; (3) the fact that the window openings were fitted with wooden sashes and plain glass; (4) lack of fire walls; (5) lack of automatic sprinklers.

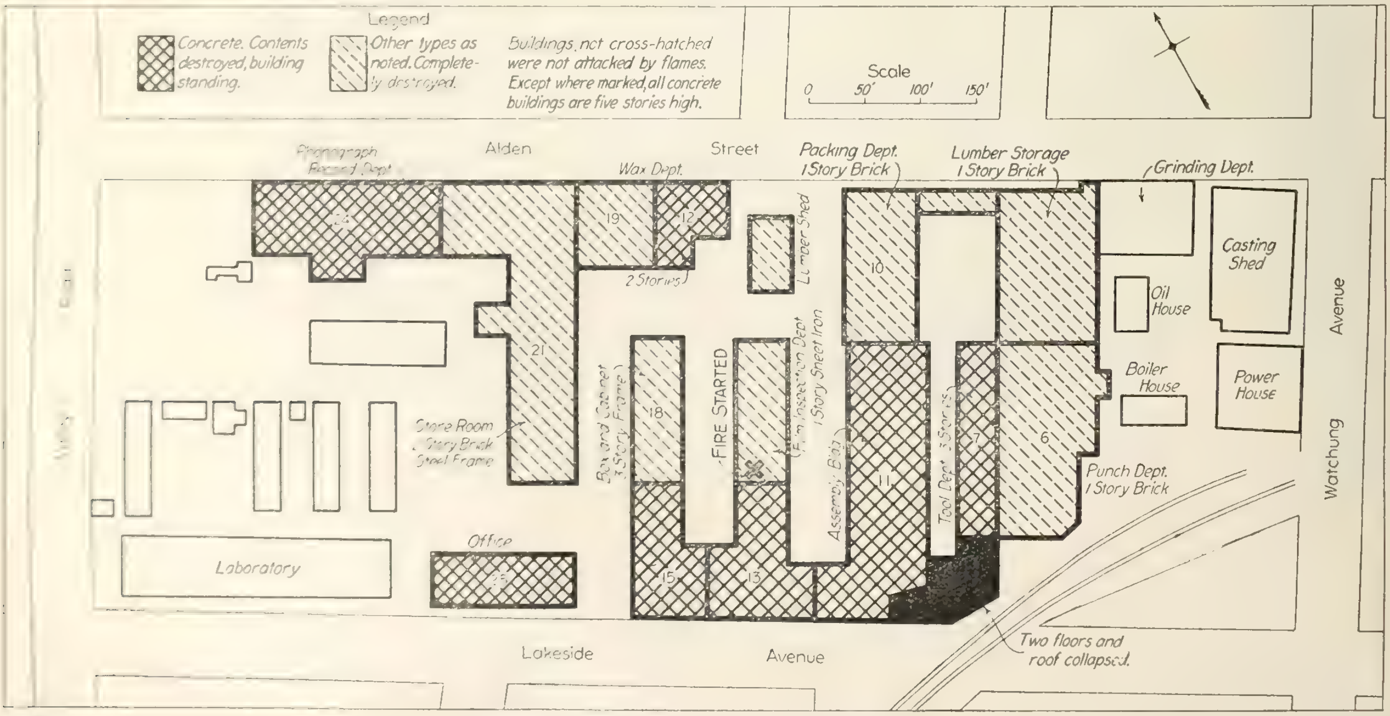
The plan reproduced herewith shows the location and type of the buildings at the plant. With the exception of certain sections in Buildings 24, 15 and 11, the concrete buildings were found in good condition. They were all standing, and the salvage of the contents will be large. This is held in marked contrast to the brick structures, where the collapse of the buildings resulted in heavy loss of contents.

The following comment on the lack of proper fire-prevention measures is made editorially by the Engineering Record:

"While chief interest would seem to centre in the performance of the concrete buildings, the most important conclusion is a costly verification of one of the fundamentals of fire protection practice. This conclusion should be preached from the house-tops—that when structures are exposed to fire hazard from without it is folly to place one's trust in "fireproof" buildings fitted with wooden window sash and plain glass. The ruin at West Orange, thrown in relief by being linked with the great inventor's name, preaches that lesson to the matter-of-fact executive more strongly than all the fire-prevention documents ever written. Here was a plant with closely spaced buildings, all of them without the fire-protection provisions which long experience has demonstrated to be essential for the safeguarding of such structures. Moreover, there were no fire walls to prevent the spread of the flames from one adjoining building to the next, and none of the buildings were equipped with automatic sprinklers. The concrete buildings were considered "fireproof," but can be called so only by courtesy. They were not fireproof, except in the sense that they themselves would not burn. They were virtually concrete stoves, with tinder at every window inviting the application of the torch.

"As for the performance of the concrete buildings in so severe a test, one can happily report that they came through very well. It is safe to say that four of the seven are in their entirety usable. In two of the remaining buildings the damage is local, affecting parts of four floors, while in the third the columns in the first floor are in very bad condition.

"Of interesting questions raised by the fire there are many. Two are especially pertinent. Was the failure to use ties or hooping around the reinforcing responsible for the damage to columns where the fire was unusually hot, as, for example, in the basement of building 11, where the expansion of the rods seems to have forced off the column corners? Are the severity and duration of the fire sufficient to account for the


Legend
Concrete. Contents destroyed, building standing.
Other types as noted. Completely destroyed.
Buildings not cross-hatched were not attacked by flames. Except where marked, all concrete buildings are five stories high.
Scale
0
50'
100'
150'
Phonograph Record Dept
Alden
Street
Wax Dept.
Packing Dept. 1 Story Brick
Lumber Storage 1 Story Brick
Grinding Dept.
24
19
12
2 Stories
Lumber Shed
10
Casting Shed
Oil House
Avenue
21
Box and Cabinet 3 Story Frame
18
FIRE STARTED
Film Inspection Dept 1 Story Sheet Iron
Assembly Bldg
11
Tool Dept. 3 Stories
7
6
Boiler House
Power House
Store Room 1 Story Brick Steel Frame
Watchung
Punch Dept. 1 Story Brick
Office
Laboratory
25
15
13
Lakeside
Avenue
Two floors and roof collapsed.

Location and type of buildings at the Edison plant.

column damage in certain sections or is the theory, advanced by the plant officials, that their failure was due to the water thrown on them while hot necessary to account for the destruction? These questions are open to argument, but as to the second we believe that the water played a critical role. Without this conclusion the strange localization of the column failures seems inexplicable, for there is reason to believe that there was very intense heat elsewhere than in the sections suffering maximum damage.

"It will be natural to use the disaster for making comparisons between different types of construction, and opinions as to the efficiency of the concrete structures under such conditions will likely be influenced by prejudices for or against this type. To the Engineering Record, however, certain conclusions, based on alternative premises, seem evident. If the untied column rods played an important part in the failures, other fireproofed types may have come through just as well. If water was the chief factor, then any other type than concrete, under the conditions which obtained in the ground floor of bulding 11, in the southeast corner of the same structure, and in the third floor of building 24, would have been on the ground, with a very much larger contents loss than in the case at West Orange. Of course the failure in 24 might have been confined to the west wing, and that in the corner of 11 to the particular section in question.

"Regardless of these views or those others may hold, all can agree that no structure, no matter what the type, should be called upon to meet such a test. The fundamental question is not as to the type that makes the best stove for inflammable contents, but what methods will prevent the spread of the flames. Fire-resisting window and door construction, fire walls and, above all, sprinklers furnish the answer."

Definite Expression in Architectural Detail

From the Building News (London)

FORM, as it develops under hammer and chisel, may typify the emergence of definite theme from nebulous idea. In like gradual manner line and lineament are evolved in the brain of the designer. We grope blindly for clear expression of that which we do not at first clearly comprehend. A hazy first notion becomes defined only as we strive to express our sentiment—as we bring the subject-matter of our thought into better and better focus. All that may reasonably be termed novel in design is no doubt produced in this way, since invention is often slow, step by step, and laborious.

In all these efforts of the brain, that which we are in reality striving to attain is definite expression—the clear-cut and logically correct transcript of mental imagery. We seek to place, with pencil on paper, the fleeting idea. We shall be well advised to exercise patience in attaining this. It will be well thoroughly to grasp and fully interpret our idea. The hasty transference of ill-considered design to solid stone will mean loss of definiteness. Some of the shadowy vagueness of our first mental conception will inhere. That which we should earnestly seek is definition. We desire the intelligible and apparent—meaning, import and significance.

It has been said that curiosity is the real overmastering passion. We are all continually asking—subconsciously, no doubt—"What is it?" In direct and indirect ways we constantly put this question to ourselves. It is ever present, as we encounter novel objects. For this reason, we must assume that the matter greatly concerns design. We should at all times remember the promptings of curiosity, and by no means dismiss the subject by counting it an ignoble passion. We should recognize the position, and remember that anything ill-defined, from carelessness or lack of sufficient thought and consideration, causes perplexity and leads to offence. We should endeavor so to present our architectural ideas that the meaning and nature of the object are never in doubt; for that which we do not, or cannot, understand or clearly comprehend engenders mystery. In this way we may be impressive, and even awe-inspiring; but since, in architecture, we seldom need to produce the mysterious definiteness of expression, obvious intention and meaning, should be our aim.

There are few more praiseworthy aims in practical architecture than an endeavor to give correct and clear expression to everything added to plain building as an ornamental accessory. We know that this general principle is at the root of successful architecture as an affair of organic constructional parts; we must hold that a similar effectiveness characterises architectural ornament that has fitting and definite expression. It is the meaningless, purposeless scroll, or curve reflex, representing nothing definite, based on no prototype, referring in no way to objects found in nature, that fails by virtue of its absence of definite expression.

If we examine ourselves, no doubt we shall find we all like to recognize, clearly, that, say, an oak or a vine-leaf is intended. We like and we admire definite expression, faithful observance of characteristic of this or that natural prototype, which the designer has taken as a model, or used as a motif. Where very highly-conventionalized ornamentation is concerned, our rule may need a little latitude in application. Yet is it to be noted that we cannot truly conventionalize, excepting as we exalt and aggrandize characteristic, and instil more of the essential spirit of the object conventionalized. If we make any one chance leaf or flower a model, we must needs produce a less characteristic representation of the genus than when we take as a model an ideal form conceived as the average of numbers of such leaves or flowers. In true and masterful conventionalizing, the spirit of the natural object is enshrined, so to say, in the ornament. By thus considering our proposition, that definiteness and ready-recognizability are most desirable attributes of architectural ornamentation—to employ a not very happy, if common, expression—we should arrive at the conclusion that in conventional, floriated enrichment, having real, natural, basic prototype, a high degree of definiteness is required in design, and is, by the very nature of the process of true conventionalizing, assured.

The belief that definiteness of expression is essential in good architectural enrichment will, we believe, be established on all grounds of inquiry. Besides the sweet reasonableness of the principle, we shall find that the [illegible] is closely related to the amount of skill and thought bestowed upon the work; and that carelessness and haste, and, obviously, ignorance are at the root of that indefiniteness of expression and lack of intent and purpose in "decorative" device, which we too often find in contemporary architecture. We curve and reflex and re-reflex, and let things go at that. It is so easy; but to produce a truly sculpturesque motif is not easy.

When we ask that question: "What is it?" we shall find, as a rule, that the readiness of answer corresponds to the amount of care and thought with which the decorative device has been executed. If we desire character in enrichment, we must go to Nature for some prototype, and let oak-leaf in wood, or stone lily, show obvious relation to this. We have, then, Nature as guide; and, truly, in decorative design, we must appeal very directly to natural form for motive and inspiration. We have no other guide, no other compass, here.

Pure geometrical ornament we may view in a somewhat modified light, although geometry is obviously natural enough. We might classify all necessary architectural enrichment and ornamentation into the quasi-natural, or "naturalesque," the more or less conventional, and the wholly geometric. In the former we must include all frankly realistic carving, the best work in which is saved from the charge of ignoble imitation by the instinct of the sculptor who imparts the sculpturesque attribute. Our principle of endeavoring to impart the fullest and most characteristic form and lineament warns us against mixed ornamentation—vegetation growing out of animals, and like evidence of debased thought in design matters. Certainly, if we encounter an object of supposed value as architectural decoration, half-tree, half-animal, we might pertinently ask: "What is it?"

All naturalesque, conventional, and geometric forms are, in reality, based on nature. In seeking to impart that fitness for architectural embellishment which differentiates slavish imitation from true ornament, we should endeavor to give to the first class of ornamentation high resemblance to prototype, short of missing that sculpturesque quality that lifts the work out of mere copyism. In highly conventionalized ornamentation, we should rather seek to instil the spirit of plant life. Taking such a decorative device as the Grecian honeysuckle, we see that it is a highly-conventionalized ornament, and over and above the special beauty of the flower that forms the motive of the design, the general disposition and arrangement of the parts displays vigour and vitality. The definite expression sought to be expressed in conventional form is, in major part, the essential grace and beauty of plant life.

We cannot but conclude that all decorative form should have reference, basically, to something natural —existent and created, or, as in the case of geometry, co-eternal. Unless this statement is carefully weighed, it may be doubted. It will, on mature consideration, we think, be found substantial, and acceptable to all but those who see beauty in meaningless scrolls, and purposeless curve and reflex. He who imagines that he can evolve true and beautiful ornament from his inner consciousness without reference to natural base or prototype—motif—practises self-deception, is less a true artist than the savage who incises roughly, simple natural objects on his door-posts, or than Palaeolithic man rudely drawing the mammoth on fragments of tusk.

Let us commence our work by asking ourselves the question: "What is it?" Such a practice followed in actual process of design might tend to rid us to some extent of the fearsome horrors of rococco ornament, and of the senseless, double-ended, curved and reflexed bone-like objects that seem an obsession in the minds of so many so-called "ornamental" draughtsmen.

Stories of Great Engineers

(From The Surveyor)

THERE is some consolation in the fact that, though the pay of the rank and file of civil engineers is still very vile, it is vastly better than it was in the days of yore—at least, in the cases of consultants of repute. It is recorded that John Smeaton was satisfied to be paid two guineas for a full day's work, and this was the man of whom Robert Stephenson spoke as "the engineer of the highest intellectual eminence that had yet appeared in England," and "the greatest philosopher in our profession that this country has yet produced."

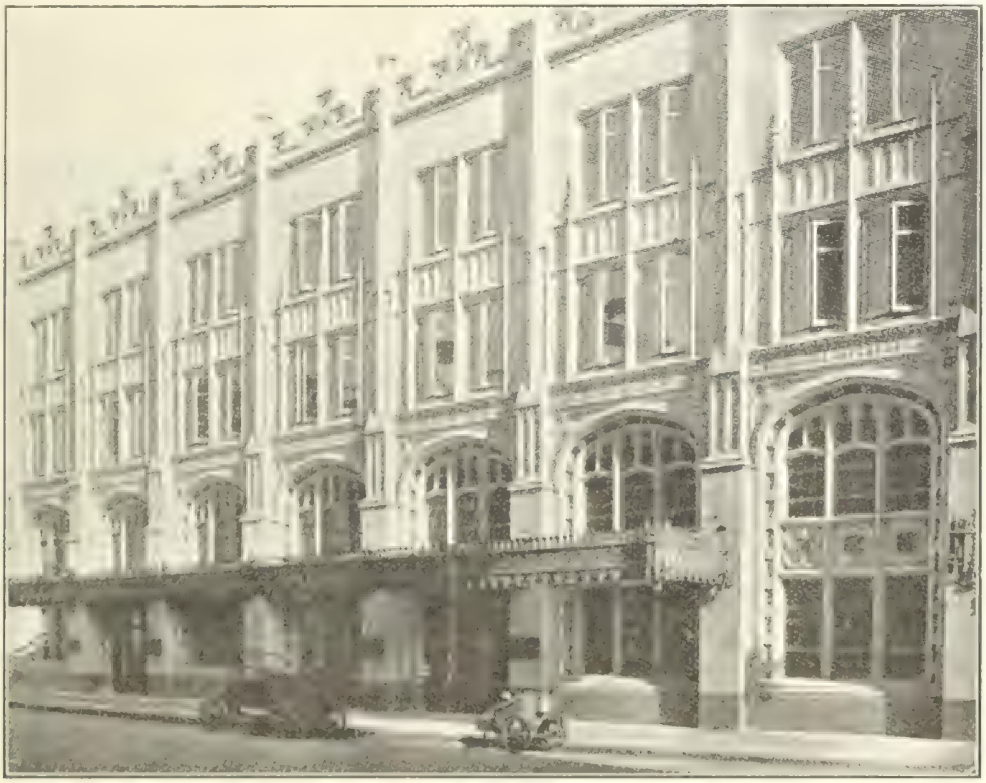
Rennie's bill against the Manchester Water-works Company for his year and a half's advice was only £159, his charge to them for a whole day's labor being six guineas. The Ordnance Department he charged seven guineas a day, and General Brownrigg, the head of the department, complained, saying it was equal to the pay of a Field Marshal. "Well," replied Rennie, "I am a Field Marshal in my profession, and if a Field Marshal in your line had answered your purpose I suppose you would not have sent for me!" "Then you refuse to make any abatement?" "Not a penny," replied the engineer—and the bill was paid.

Have we any leading engineers as versatile as John Rennie? During his college career he read Emerson, Switzer, Maclaurin, Belidor, and Gravesande, allowing neither pleasure nor society to divert him from his studies. As a relaxation he learned French and German, and was shortly able to read both with ease. His recreation was mostly of a solitary kind, and having a taste for music he acquired considerable proficiency on the flute and the violin, and even went so far as to buy a set of bagpipes and learn to play upon them. But when he left Edinburgh the extensive nature of his engagements so completely occupied his time that in a few years flute, fiddle and bagpipes were laid by altogether.

Among John Rennie's earliest pieces of workmanship was a fleet of miniature ships, which he made when he was only about ten years old. Shortly after, by the advice and with the assistance of his friend Meikle—who took as much pride in his performances as if they had been his own—Rennie made a model of a windmill, another of a fire engine (or steam engine), and another of Vellore's pile engine, all displaying a considerable amount of manual dexterity. According to Dr. Smiles' "Lives of the Engineers," at least sime of these early efforts of the great engineer's boyish genius were still in existence some ten years ago. It would be interesting to know if they still exist, and, if so, where.

The total value of the stone produced in the United States in 1913 was $83,732,995, as compared with $78,193,220 in 1912, an increase of $5,539,775, or 7.08 per cent. The year surpassed all previous years in the value of granite, trap rock, sandstone, marble and limestone, increasing 8.17, 22.88, 2.02, 1.08, and 5.49 per cent. respectively over the value for 1912.

A New Winnipeg Hotel with Up-To-Date Constructional Features



Attractive exterior of the Olympia Hotel, Winnipeg.

IT is claimed for the new Olympia Hotel at Winnipeg that it contains some of the finest architectural work in Western Canada. At least, this is one of the features which entitles the building to special mention. The hotel, which is of steel construction throughout, with hollow fireproof tiling, is four storeys high, with basement and sub-basement, and contains accommodation for two hundred and fifty guests. The exterior finish is executed in terra-cotta, with gray brick facing the lanes and light wells. The fire escapes and stairways are enclosed in fireproof compartments opening into the corridors through metallic doors with wired glass. The architectural style follows the Gothic and Renaissance. The material used is a soft grey terra-cotta, which starts from the polished concrete base. The flat walls of the upper storeys terminate in a line of battlements deeply carved and ornamented. A feature of interest is the massive marquise which extends across the front and sidewalk, the whole structure being of cast iron and glass.

The rotunda and lounge are entered from the north vestibule, which is finished in oak and stained glass. The ceiling, which is heavily moulded and stencilled, is supported by massive pillars rising from a base of grey marble. The walls are of buff Caen stone, rising above a wainscotting of Tavernell marble, with floors of a colored variety of Tennessee marble. Here Gothic influence is seen in the arched openings, the heavily ornamented ceiling, the hammered brass fixtures and the stained glass doorways.

The commercial atmosphere of the routine offices on the ground floor is relieved by the excellent taste in woodwork and the skilful planning. The public telephone booths are of inlaid walnut, and are finished with stained glass doors and windows.

Adjoining the lounge is the ladies' reception room, dining-room, bar, and service department. The main stairs, which are of marble, lead to the mazzanine hall on the second floor and to the grill room in the basement.

The guest rooms are commodious and well lighted. The private baths adjoining are fitted with porcelain fixtures, while the floors are finished with a composite white tiling. The approach to the mezzanine hall is by a staircase of Tennessee marble leading from the rotunda. The walls of the hall are panelled with a tightly stretched fibre covering. A heavy railing of bronze-stained oak separates the panels from the deep plaster frieze. The ceiling is arched and ornamented with a continuation of the sidewall decoration.

The design of the tea room follows that of the mezzanine hall. The beamed ceiling is supported by large pillars. Natural lighting is obtained through broad arched windows and skylights.

The dining-room, which is two storeys high, follows the Renaissance design. Here there are tapestried pillasters, with silk cord side-light fixtures suspended therefrom. Light is furnished through panels of stained glass.

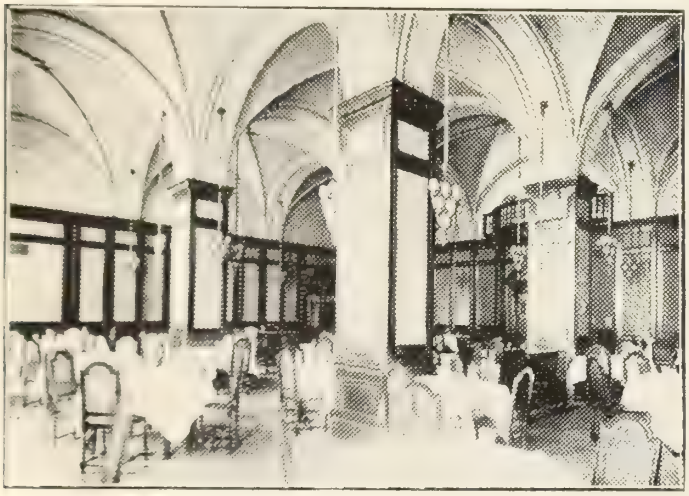
The interior of the buffet is a particularly fine example of Gothic. Like the dining-room, it is two storeys in height. The walls west and south are faced with buff Caen stone rising above a base of polished marble. Iron lanterns are suspended from the heavy oak rafters. The appearance of the room is enhanced by a series of mural panels depicting Norman scenes. The floor is of red tile.

The walls of the grill room are finished with tapestried brick. The ceiling is done in light cream with skylights of the same tint. The floors are of red square tile and black mortar. The grill is separated from the lobby and coat room by an oak door.

Power is so cheap in Winnipeg that it was not considered advisable to install a generating plant. There are connections, however, with both the city lighting and street railway power, which will prevent inconvenience in the event of damage to the regular sources of supply.

In the basement there are large boilers of the Scotch dry back type. These are internally fired by Morrison suspension furnaces. There are three of these boilers, each developing 150 h.p.

The hotel has its own wells, which are drilled to bed rock. Water is stored in large tanks from which it is distributed through the water softeners, the domestic supply tank, and the high pressure tank in the pump house on the roof. Owing to the fact that the basement extends below the level of the city sewers, pneumatic and electric sewage ejectors of a noiseless type have been installed.


Dining Room, Olympia Hotel, Winnipeg.

The cost of the building proper is estimated at $600,000, and with furnishings at $1,000,000. The general contractors were the Carter-Halls-Aldinger Company, Limited, Winnipeg.

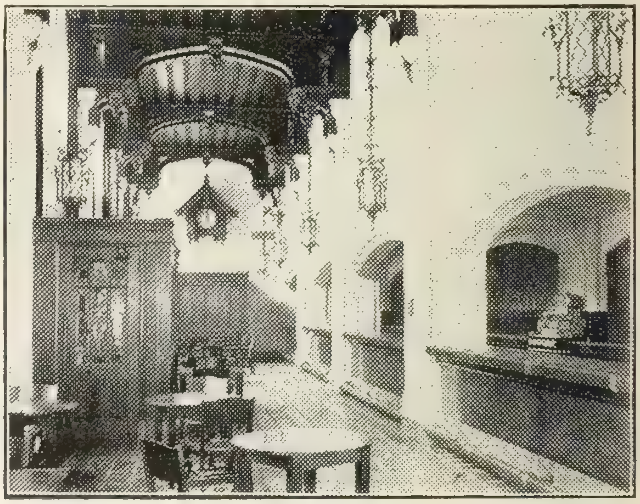
Blasting frozen bulk freight, such as sand, clay, rock ballast or ore, is recommended in the October issue of the DuPont Magazine. The following directions are given: Use a slow-acting dynamite in small quantities, say one-fourth or one-half of a 1¼ x 8-in. cartridge per charge. Make a hole with a crowbar in such material as broken stone, and with an auger in sand or clay. The charge should be not less than 2 or 3 ft. from the side or bottom of the car. Tamp the hole when loaded and fire the charge preferably with an electric detonator, although a blasting cap and fuse may be used. It is stated that the material may be opened up in this way without damage to the cars and without throwing the material.

An interesting incorporation at Montreal is that of the International Lime Company, Limited, which is capitalized at $200,000. The incorporators include Messrs. W. K. McKeown, Henri Lacerte, E. A. Barnard and G. E. Chart, all of Montreal.

The Behaviour of Reinforced Concrete in Fires

THE ability of reinforced-concrete construction to resist severe fires has been demonstrated in three recent conflagrations, at Kingston, Ont., Youngstown, Ohio, and Kansas City, Mo. In each case the heat was intense and in two of the fires the adjoining structures were destroyed completely.

At the plant of Davis & Sons' Tannery, Kingston, there were two buildings side by side, one a Kahn-system reinforced-concrete structure, the other a brick dwelling with interior wood construction. These two buildings were joined at two points toward the end. The fire completely demolished the brick building, while the reinforced-concrete structure in the midst of the flames was practically uninjured. So intense was the heat that the wire glass in the latter building was melted to a liquid and hung like icicles in various places. The wooden water tank on the top of the structure was reduced to a mass of chars, but has since been replaced. All that remained of the brick building, which was four storeys high and filled with leather and machinery, was a mass of scrap iron, steel and brick.


Buffet, Olympia Hotel, Winnipeg.

There were also in the fire an engine house and a leach house. The brick walls and wooden roof of the engine house were entirely destroyed. The leach house, which has concrete walls and a wooden roof, shows the concrete walls still standing, while the interior was completely gutted.

In the fire of J. R. Thomas & Sons' wholesale warehouse, Youngstown, Ohio, the heat was particularly intense, as the contents were of a highly inflammable nature. The building was about 100 ft. square and six storeys high, and at the time of the fire was well filled with stock.

Two carloads of matches stored at one point of the sixth floor under the roof were reduced to a mass of ashes. These matches burned intensely for three hours, during which the temperature was continuously at about 1,700 deg. Fahr. Careful examination of the reinforced-concrete roof above this point showed practically no damage. The bottom of an occasional terracotta tile was broken off, but this was readily repaired by metal lath, and plaster.

The cause of the fire, although not exactly known, is believed to have been due to the explosion of rat poison, which simultaneously started the fire on the second, fifth and sixth floors. The explosion was of such violence as to blow out the wall on the south side of the building on the upper two floors, but no damage was done to the reinforced-concrete construction.

The floors and roof consisted of a combination of reinforced concrete and hollow tile. In this system the rows of terra-cotta tile were separated and supported by concrete joists reinforced with Kahn trussed bars. This reinforced-concrete floor was supported on structural steel beams and columns incased in concrete. The floors were designed for a live load of 250 lbs. per square foot.

On another part of the floor brooms were stored, some of them being hung from the ceiling and others resting on the floor. So intense was the heat that the handles of these brooms were entirely consumed, but the floor construction showed no signs of damage. Paper bags were piled up to the ceiling on one part of the second floor, and burned fiercely until entirely consumed, yet the only damage to the floor above was to the bottom side of a small area of hollow tile. That the floor iteslf was not weakened by this intense fire is shown by the fact that above this portion were stored boxes containing canned goods weighing about 300 lbs. per square foot. There was no apparent sign of deflection of the ceiling below.

After the debris resulting from the fire had been cleared out, in order to ascertain whether the floor had been weakened in any way by the fire, a test was made. A load of 300 lbs. per square foot was placed over the location where the fire had been most intense, and the total deflection of the floor was less than 1-16 in. In this way it was determined that the floors had not been weakened and that they will not have to be replaced. The only repairs required are a slight patching up. The entire concrete construction can, it is stated, be repaired at the expenditure of a few hundred dollars, although the damage to the stock amounted to more than $200,000.

A conflagration occurred recently in the First Christian Church Annex, Kansas City, Mo. The first and second floors of the annex were of reinforced concrete, steel Floretyle construction of the Trussed Concrete Steel Company being used. The upper three floors were constructed of cast-iron columns, steel beams and wooden joists. The building was in course of construction at the time of the fire, and the Hy-Rib ceiling had not been plastered on the under side. Hence the Floretyle construction was subjected to a more severe test than would be expected in a completed building.

The upper three floors of the annex and the church itself were destroyed by the fire. In addition to this the first floor was divided into a number of rooms by wooden partitions which burned up completely, but this additional heat did not affect the construction.—Engineering Record.

A total of 19,881,714 cross-ties were purchased by the steam and electric railways of Canada during 1913, according to a Forestry Branch Bulletin. In 1912, a total of 21,308,571 ties were purchased. Of the 1913 total, [illegible] per cent. were of jack pine; 12.3 per cent. white cedar; 12.2 per cent. Douglas fir; 6.2 per cent. western larch; 6 per cent. hemlock; 5.7 per cent. hard pine; 4.9 per cent. oak; 4.4 per cent. tamarack; and small percentages of western hemlock, spruce, chestnut, red cedar, red pine, beech, birch, maple, elm, ash and cherry.

The Status of Air Ozonation

At a recent meeting of the American Society of Heating Engineers, Mr. M. W. Franklin presented a paper on the above subject, and in the discussion which followed an interesting comment was made by Professor J. D. Hoffman, of the University of Nebraska.

The Professor based his remarks on the following statements which the author had made in his paper:—

"According to the modern theory of ventilation, the only baneful factors in 'vitiated' air are heat, moisture and odors."

"It has been shown that in the worst cases the available oxygen is far in excess of the demand, and that CO_2 is harmless in concentration likely to be met. The conviction once prevalent that organic 'crowd poisons' were the guilty factors likewise has been abolished."

"The most recently demolished belief was that bacteria existed as a menace in re-breathed air."

"The modern practice of ventilation, then, clearly is concerned only with absorbing the almost invariable quantity of heat produced per capita of room occupants, of removing the moisture transpired, and of destroying the odors generated, etc."

Professor Hoffman remarked that, according to these quotations, there was no question of doubt concerning the wholesomeness of respired air if it was only kept at the proper temperature and humidity and kept free from odors. In imagination, let two men be taken, of equal normal health qualifications, except that one had lost the sense of smell. These men were subjected to an atmosphere heavily charged with offensive odors, and the question was whether the man with the normal sense of smell would receive the greater injury.

Certainly, odors were not harmful; they merely indicated the trouble. Personally he (the Professor) was inclined to regard the sense of smell as an easily-applied proof of the stagnation of the air, comparable in a way with the CO_2 test, which was a proof of the amount of fresh air supplied and the distribution of the air in the room. As to eliminating odors as being merely unpleasant and not harmful, it might be asked "How about temperature and humidity?" Surely heat and water were not baneful factors or harmful to the human body, except as taken in extraordinary amounts.

No person contended that an otherwise pure atmosphere, having less than normal oxygen or more than normal CO_2, would be fatal or immediately harmful, although its subtle influence upon health by long continued applications to those conditions had still to be proved.

Referring to "crowd poisons," Professor Hoffman said that, even if able to define them, was enough known about them to be sure there were no such poisons? Was it conclusively proved that bacteria did not exist in respired air? The careful observer would insist that judgment upon those most vital points should be exceedingly deliberate.

To subject persons in normal health to bad air conditions for a few hours or days, and then draw conclusions as to the permanent health effects, was not good logic. Because persons might stand certain unsatisfactory surroundings for a brief period without apparent harm did not argue that the same persons could continue this indefinitely.

Concerning bacterial and germ poisons, there were many convincing object lessons to be seen around them. In a family of his acquaintance, one member contracted tuberculosis in an unhealthy trade, and lay for some time before being taken. At this time, all the other members of the family seemed in normal health. But within a couple of years two more were taken in the same way, although the disease was contracted differently from the first case. The remnant of the family was advised to move to other quarters, and so far as he had learned, no more were taken. The sentiment was expressed that leaving the old home, which no doubt was thoroughly filled with the germs of the disease, saved their lives.

Another case which exhibited conditions fully as striking was called to his attention. In a fraternity house one of the boys contracted tuberculosis, and, while sitting by himself, used one of the discarded heat stacks as a spittoon. After his death one after another of these splendid fellows gave up their lives until the fraternity was completely demoralized. After the cause of the scourge was learned, and a move was made to other quarters, everything was satisfactory. Hundreds of such cases could be cited.

Of all the delicate machinery enclosed in the human body no part had more effect upon the general health than the incinerator or purifying plant termed "the lungs." When these were not supplied with air of proper quality or amount, or when they were thrown out of service by disease, stagnation ensued.

The Professor went on to say that he was convinced the author of the paper under discussion did not wish them to understand that the wholesale destruction of former precedents and ideals in ventilation, as specified by him, was unconditionally recommended. As to the first quotation, the word "baneful" meant having poisonous qualities, the state of being harmful or destructive, etc. The author had stated "So far as is definitely known, the value of ozone in ventilation is not due to any beneficial effect upon the human economy, but to the circumstance that it destroys much that may be objectionable or harmful in foul air, etc." The whole value of his paper was based upon the fact that ozone had the power to destroy bacteria and harmful substances floating in the air, and since he (Mr. Franklin) recognized ozone to be a powerful germicide, he recommended it as an accessory to the modern ventilating system.

The Professor remarked that he had no criticism to offer upon this view of the subject except to say that the person not accustomed to inhaling ozone had better begin with very small amounts and increase the dose gradually. In experimenting with an ozonator he had found it necessary to limit its use, because of the influence of the ozone upon the membrane of the nose and throat of those persons regularly employed in the office. In the lecture-rooms, however, where there were large room volumes and many people, the room air was freshened and deodorized and no complaints were made by any persons subjected to its influence for one hour.

The author's paper, therefore, as an exponent for the use of ozone in the art of air conditioning, deserved commendation, but it weakened its position in making final and sweeping conclusions concerning those phases of air conditions upon which there was, as yet, so much uncertainty.

His conclusion was merely this: When air conditions within room interiors become the same as those of the pure outside air, the best physical health of the people might be expected.

Slag as an Aggregate in Concrete*

By W. A. Aiken

EVERY new or extended utilization of by-product makes for economy in the conservation of resources. The millions of tons of blast-furnace slag annually produced in the United States, for years considered not only practically worthless, but always a nuisance, and entailing unavoidable expense in handling and disposal, have from time to time to some extent been utilized in a variety of ways; one very important use of certain of these slags being in the manufacture of a valuable product, Portland cement. But the percentage of furnace slag made use of thus, or indeed in any other way, such as for track ballast or for building macadam roads, is at present relatively very small, and yet is actually considerable in tonnage. Any increase in the use of this product to the extent outlined in this paper, should the adaptability of slag for concrete aggregate be generally recognized, would furnish a very desirable outlet. To be sure, its adaptability for this purpose has always been recognized by large iron manufacturers, who early made use of this handy material, when concrete construction was undertaken around their plants; but it has not been adopted generally.

With the marvellous growth in recent years of concrete construction, and especially reinforced concrete, the advantage of furnace slag as an aggregate in reducing the dead weight per cubic foot of concrete, has made a strong appeal to many concrete engineers. The result is that the building codes of several of our large municipalities have permitted the use of furnace slag equally with any other material ordinarily used for aggregate in concrete.

In the course of our professional work during the past year we have made an extended investigation of certain slag-concrete. The particular value of our work, we think, lies especially in the fact that any conclusions to be drawn therefrom are based on a large number of test results, very much more than the number from which averages are ordinarily deduced. In consequence, we feel that any deductions submitted are reliable, and while tests on slag-concrete specimens have often been made previously, and the results in some cases published, so far as our examinations of these are concerned the number of tests from which average results were deducted at each period was comparatively limited, and, consequently, the conclusions therefrom are correspondingly less reliable.

Originally we made a few comparative tests using different aggregates, such as limestone, Birdsboro trap rock, and slag; the tests being carried on only to the twenty-eight-day period. This was done to arrive independently at the relative actual values of these different materials. As a result of these early tests and the showing made therein by slag, we undertook an extended series of tests involving the manufacture of five hundred 6-in. cubes; 100 of these to be crushed at each of the several periods—28 days, 3 months, 6 months, 9 months, and 1 year—so as to arirve at entirely reliable averages, and to establish the uniformity of the character of the concrete. As the work progressed results were such that the number of cubes tested at the 9-month and 1-year periods was reduced to 50 each, and it is proposed to crush the remaining 100 cubes at 6-month intervals up to 6 years—10 cubes at each period.

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*Paper presented at the last annual meeting of the American Society for Testing Materials.

The materials used in this investigation were all commercially procured in Philadelphia, and the work of making the specimens was no better than that under ordinary field conditions of concrete construction—no attempt having been made to enter into any elaboration. Thorough mixing, however, was positively assured, the work being done by hand. The moulds used were in gangs of tens and made of planed 1-in. white pine lumber, put together with screws. The cement used was a standard Lehigh Valley brand, showing the following compliance with the standard specifications of the American Society for Testing Materials:—

Fineness.—No. 100 sieve, 96.0 per cent. passing; No. 200 sieve, 81.2 per cent. passing.

Time of Set.—Initial set, 5 h. 30 m.; final set, 6 h. 10 m.

Constancy of Volume.—Passed the cold water-pat, air-pat, steam-pat, and boiling-pat tests favorably.

Tensile Strength.—(Average of five briquettes.)

Neat.

24 hours.	7 days.	28 days.
219 lbs.	601 lbs.	704 lbs.

1 cement: 3 sand.

7 days	28 days.
272 lbs.	347 lbs.

Temperature of laboratory air, 70 deg. F.

Temperature of gauging water, 68 deg. F.

The sand used was Jersey gravel, the material almost universally used in the vicinity of Philadelphia. This showed the following granulometric analysis:

Sieves	Amount Passing
¼ in.	97.4 per cent.
No. 10	90.8 "
No. 20	72.8 "
No. 30	63.8 "
No. 40	55.2 "
No. 60	35.4 "
No. 100	11.6 "

This is not ideal material, as will be recognized, but was used because it is the material of the market.

The coarse aggregates, commercially called ¾-in. material, all passed the 1¼-in. sieve and were retained on the ½-in. sieve.

The slag used showed the following chemical analysis:

Silica (SiO_2)	34.40 per cent.
Alumina and iron oxide (R_2O_3) ...	23.40
Lime (CaO)	35.88
Magnesia (MgO)	3.21
Sulphuric anhydride (SO_3)	0.39
Sulphur	1.27
Loss on ignition	1.34

All material was measured by volume in the proportions of 1 part cement, 2 parts sand, and 4 parts coarse aggregate—this being the requirement of the Philadelphia Building Laws. All the concrete was mixed to ordinary work consistency—rather wet than dry.

The preliminary investigation for comparative purposes gave the following average results from three 6-in. cubes at 7 days and three 6-in. cubes at 28 days.

Coarse Aggregate	Compressive strength lbs. per sq. in. 7 days	Compressive strength lbs. per sq. in. 28 days
Limestone	[illegible]	941
Birdsboro trap rock	1,144	1,888
Slag	1,681	2,537

There was then undertaken the main investigation covering the manufacture and testing of the 500 slag cubes. These were all air-stored in a dry cellar, being sprinkeld with water once a week.

A study of the detailed differentiation of test results shows that at 28 days, 3 months, and 6 months, of the number of individual tests failing to closely agree with the several general averages, the large percentages of these show considerably greater strength than these general averages or than the average of the larger percentages of tests which agree so closely with the several general averages. The average strength noted in all tests at these periods—28 days, 3 months, and 6 months—may, therefore, be assumed as thoroughly conservative.

A similar study of results at 9 months and 1 year shows that of the results not in close agreement with each period's general average, or with the larger number of tests at each period which closely approximate these general averages, a somewhat larger percentage falls below this general average than that which runs above. But as those results which are above the general findings average relatively much more above such general findings, than the low results average below these general findings, it may again be assumed that the average strength results of all tests at the later periods of 9 months and 1 year are equally conservative.

This is more particularly evident when it is borne in mind that the sand used was not what could be considered first-class material, and undoubtedly influenced the strength of the concrete developed. Also, the comparatively small size of the slag aggregate must necessarily have influenced the strength of the concrete, while the results would probably have been higher had the test specimens been larger. It is also to be noted that, in so far as the author's observation goes, the results are markedly lower than those published by other investigators of slag concrete.

The main point is whether the compressive-strength values herein developed are sufficiently great to warrant the employment of slag as aggregate, in competition with broken stone and gravel. We think the findings are in favor of this, since our experience has been that the crushing strength of broken stone or gravel concrete, made up under ordinary field conditions, will not average over 1,500 lbs. per square inch at the age of thirty days.

Consequently, from the actual strength of the concrete developed in these tests; its weight per cubic foot (which is less than that of most materials used similarly); the recognized solubility of slag, which permits it to act as a puzzolanic material; its alkaline nature, which is especially conducive to rust-prevention in the case of reinforced concrete construction, and from the relatively high combined percentages of silica, alumina, and iron, which make for permanency of the resulting concerte: we conclude that slag of similar constitution is in every way satisfactory for use as aggregate in concrete.

To make a hole in glass, cover the glass with clay or putty for a few inches around the place where the hole is wanted. With a pencil or small stick, make a hole in the clay or putty the size of hole required. Pour this hole full of melted lead.

The Welland Canal, for which all contracts have been let, is to be finished by 1918 at a cost of $50,000,000, all of which is to be borne by the Dominion Government. At present about two thousand men are at work excavating the northern end of the canal.

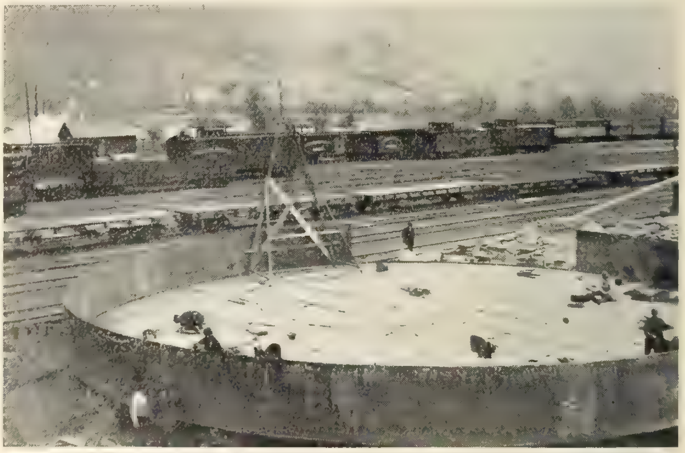
Fuel Oil and Its Application

An interesting paper on the above subject was presented by Mr. J. J. Ferris, late Superintendent of the Oil Service of the C. P. R., at a meeting of the Vancouver Branch of the Canadian Society of Civil Engineers on December 3.

Mr. Ferris prefaced his remarks concerning the use of fuel oil by a brief outline of its history. Oil was known before the Christian Era. The Chinese and Japanese worked oil deposits in a primitive way for centuries and both the Incas of Peru and the Aztecs of Mexico employed petroleum in their works of art. In Galicia and Roumania are old workings that show that petroleum was extracted there ages ago. As early as 1856, settlers of California collected the more liquid petroleum from seepages and refined it in a crude way, but this was not a success financially. The first drilling for petroleum was done by Colonel Drake in the Appalachian Mountains of Pennsylvania in the year 1859. In 1871 the first well in Russia was drilled at the oil-fields of Baku.

Owing to the lack of facilities for handling crude oil, progress was very slow and unprofitable until the year 1865, when it was demonstrated in America that oil could be transported advantageously through steel pipes. Following the example of America, Russia constructed a pipe line for transporting oil to the Caspian Sea, and in 1879 the first steamer ever built for transporting oil was built by a Russian firm for carrying oil across the sea.

Field, B. C.—15,000 bbl. storage and 600 bbl. gauging tank, with concrete pump-house.



Kamloops, B. C.—Bottom and first ring of 15,000 bbl. storage tank.

Very little development work was done in California until 1892, and within three years some two thousand four hundred oil companies filed incorporation papers in the state. But of these twelve hundred companies did some actual drilling.

Oil was discovered in Eastern Canada in the late seventies with Ontario leading in the output, having paying wells since 1881. Numerous oil indications have been found in Alberta, British Columbia and Athabasca—especially in Athabasca, where there are immense asphaltum beds. The latest excitement is in Alberta, at a place called Cochrane, on the Canadian Pacific Railway, the oil wells being near this town. There oil was struck at a depth of 1,620 feet. It is a high grade oil similar to that found in Pennsylvania.

Oil-bearing strata are principally of a porous character, such as sands, sandstone, limestone and gravel. Some of the oils from Ontario and Eastern United States and Texas are found in limestone, but apart from these most of the oil in the world is found in a sandy formation. The drilling, as a rule, is through hard pan, clays, limestone, sandstone and sands, all of different hardness and thickness and as a rule, but not always, the oil sand lies under a stratum of clay. The majority of the oil flowing wells contain water of a saline nature, and it is said that the search for brine led to the discovery of petroleum in the United States. In some places salt has been produced on a commercial scale, by evaporating water pumped from wells sunk in oil strata.

The depth of oil wells varies greatly. In Ontario there are oil wells at a depth of only 500 feet, although some again are over 3,000 feet deep. In California they are from 600 to 4,000 feet deep, and cost about $5.00 per foot for drilling, including casings. This is the contract price when several wells are to be drilled. The rig for drilling is a derrick from 50 to 80 ft. high, with a base from 16 to 20 ft. On the top are two pulleys, one known as the crown and the other as the sand pulley. The drilling is performed by a heavy string of tools suspended from a flexible Manila cable 2 x 2½ ins. diameter. These tools then fall back by gravity. The cable is attached to a drum, known as the bull wheel, for lowering and hoisting the tools.

Steel casing is the casing generally used when drilling a well, the size of casing depending on the depth of the well and character of strata. As a rule the string of casing is 12½ ins. inside diameter and finishing with 6½, 5 3-16 or 4 ins. inside diameter, this, as said before, depending on the condition of strata, water, etc. The last casing must be tight to prevent the water between the surface and the oil bodies from mixing with the oils, and also in case of a heavy pressure of gas or oil, to keep it from breaking through the earth near the surface. Where the ground is fairly level and open, and the wells are within 600 or 700 ft. of each other, as many as 25 wells can be pumped from a central station by Jerker lines. A common type of pumping frame is a vertical shaft driven by a bevel gearing from a horizontal shaft, several eccentrics being attached to the vertical shaft, with a number of holes in the outer flange for fastening straps or cables (Jerker Lines) leading to the different wells.

The oil from the wells is pumped into sumps, allowing the sand and water to settle. From there it is pumped to large storage reservoirs built of earth. These reservoirs are scraped out with teams, the material being used for the embankment. The bottom and banks are water soaked and teams driven over them until they become dry. These dry quickly during the hot weather, making them practically tight from seepage. There are also earth reservoirs lined with concrete reinforced with wire mesh. The Union Oil Company have three reservoirs built entirely of concrete. These are 600 feet in diameter by 22 feet 6 inches high having a capacity of 1,000,000 barrels. The oil is drawn off through pipes in the bottom of the reservoirs to tanks, where it is heated in cold weather, then pumped through pipe lines to the refineries or storage tanks on the coast. From here it is loaded on tank steamers for transportation. These steamers have a capacity of from 25,000 to 75,000 barrels.

There are several long pipe lines throughout the state of California. At present one 8 ins. in diameter is being laid between Coalings and Martinez, a distance of about 178 miles. The longest pipe line, to the writer's knowledge, is 280 miles long and extends from the Kern River fields to the Point Richmond refinery. This is operated by the Standard Oil Company. The pumping stations on the pipe line are from 5 to 20 miles apart, these distances depending on the grade of the line it passes over.

The crude oil found in the Eastern States and Canada is mostly of a paraffine base, while that on the Pacific Coast is of an asphaltum base. Paraffine base oil is too valuable to use as a fuel oil, as there are some three hundred articles of commerce manufactured from it.

C. P. R. Installation Effects Great Saving

There are a great many wells producing oil of a gravity that does not need distilling for use of fuel oil, while there are others of too low a gravity which are mixed with a higher gravity oil, producing a gravity suitable for the purchaser—for instance, the C. P. R. use a 14 degree gravity Baume for their steamships, and a 17 degree for their locomotives. These oils are delivered in Vancouver by the Union Oil Company's tank steamers to three 55,000-barrel storage tanks situated near Coal Harbor. Each barrel contains 42 gals. U. S. measure. The oil is distributed from these tanks to the steamboats and along the main line of the railroad for the locomotives and stationary boilers.

At the three storage tanks there is a pumping plant. This plant has two 150 h.p. water tube boilers and two compound duplex pumps, having a capacity of 500 barrels each an hour. The piping is so arranged that either pump can be used from any one of the tanks. The oil is pumped from these large tanks to gauging tanks of 1,000 barrels capacity; and from here to the steamers by an electrically driven pump through a pipe line placed under the dock, along the water front. The oil is also pumped from the large storage tanks to the tank cars. These tank cars have a capacity of 240 barrels each, and distribute the oil to the different pumping stations along the main line of railroad, from Vancouver to Field, a distance of 510 miles.

Following are the stations, in order, according to the capacity of their tanks:—There is a 600-barrel gauging tank, erected on a steel tower 20 ft. high, at Vancouver, Mission Junction, Sicamous and Golden; a 1,000-barrel gauging tank, on 20 ft. tower, at Notch Hill, a 15,000-barrel storage and a 600-barrel gauging tank at North Bend, Kamloops, Rogers Pass and Field; a 22,000-barrel storage tank and 600-barrel gauging tank at Coquitlam and Revelstoke. At each of these stations is a pumping plant and a concrete unloading sump, into which the oil from the tank cars is emptied and from there pumped to the storage and gauging tanks.

The plan for distributing oil to the locomotives is to pump from the storage tanks or sumps to the gauging tanks, but it is so arranged in case of accidents to tanks that the oil can be pumped direct from sumps to locomotives. The sumps mentioned are of concrete 16 x 16 x 6 ft. deep, built in the ground, the top of same built level with the top of the rail. The sumps and tanks are equipped with a system of heating coils to keep the oil from becoming thick and heavy during the cold weather, and especially in the gauging tanks, from which it is delivered through the stand pipes to the locomotives by gravity.

In conclusion, we have in favor of liquid fuel the following points: ease of transportation and hauling; reduction of storage bulk; increased cleanliness both inside and outside of boiler-room; reduced labor in firing; reduced cost per unit of heating value; increased percentage of efficiency; increased steaming capacity of generators, and great ease of regulation.

Preventing Odors at Refuse Disposal Plants

HIGH furnace temperatures, forced draft and careful regulation of the fires to secure perfect combustion are necessary to prevent odors at refuse disposal plants. These are among the points made by Dr. Rudolph Hering, consulting engineer, of New York, in a paper presented at the recent meeting in Jacksonville of the American Public Health Association.

To prevent odors about the plant, Dr. Hering said, no refuse should be stored longer than a day before it is incinerated, although an offence from mixed refuse does not arise as soon as from garbage alone as generally delivered at a reduction plant. It is further generally wise to arrange hoods and ventilating pipes in the furnace building to receive and carry the air, which may have become somewhat foul from contact with the refuse. The foul air should be conducted to a point below the furnace grates and used with forced draft, so that the intense heat of the fire will thoroughly purify it.

As at reduction works it is advisable to keep incinerating works scrupulously clean. No refuse should be left scattered about. Dust from the final clinker and ashes should be properly controlled, and the floors of the buildings should be swept or washed daily. The walls of the buildings, the tools, clothing, etc., should be given, as often as found desirable, a blast from nozzles supplied with compressed air.

A Pennsylvania wire glass company has evolved a new type of glass that solves a problem often of great importance in manufacturing plants—that of eliminating the drip from the underside of skylights. In many of the arts, in silk and cotton mills, paper factories, chocolate works, etc., the falling of a single drop causes great damage. The new glass is called "Aqueduct" and the under-surface has eight webs or channels to the inch, the webs being of such form as to give the greatest degree of capillary attraction. The result, says Safety Engineering, is that, even when pitched as low as ten degrees above the horizontal, all condensation is held and carried down to the gutter at the foot of each sheet. The strength added by the webs is so great that the makers guarantee the glass for one year against breakage from any cause whatever. This company is the first in the history of glass manufacture to make such a guarantee.

Design, Construction and Detailed Costs of the Richelieu River Bridge

THE renewal under traffic of the Richelieu River Bridge at Lacolle Junction, Quebec, by the Grand Trunk Railway possesses a number of interesting features. This bridge, which spans the Richelieu River, the northern outlet of Lake Champlain, originally consisted of a 180-ft. swing span (providing two clear channels of 73 ft. each) and pile trestle approaches, the east approach having a length of 350 ft. and the west one a length of 500 ft. The centre pier and the rest piers of the old swing span consisted of timber cribs filled with rubble stone surrounding the supporting piles, the latter being capped with timber grillage which in turn supported concrete tops. The superstructure for the new bridge consists of thirteen piers, including the pivot pier, and two abutments. In addition to the construction of these piers and abutments the renewal of the bridge required the reconstruction of the old protection cribwork, the construction of wing protection cribs and booms, and the removal of the old protection works, rest piers and trestle. The work was completed in 1913 and is described very fully in a recent issue of our Chicago contemporary, Engineering and Contracting, whose article we present herewith in abstract.

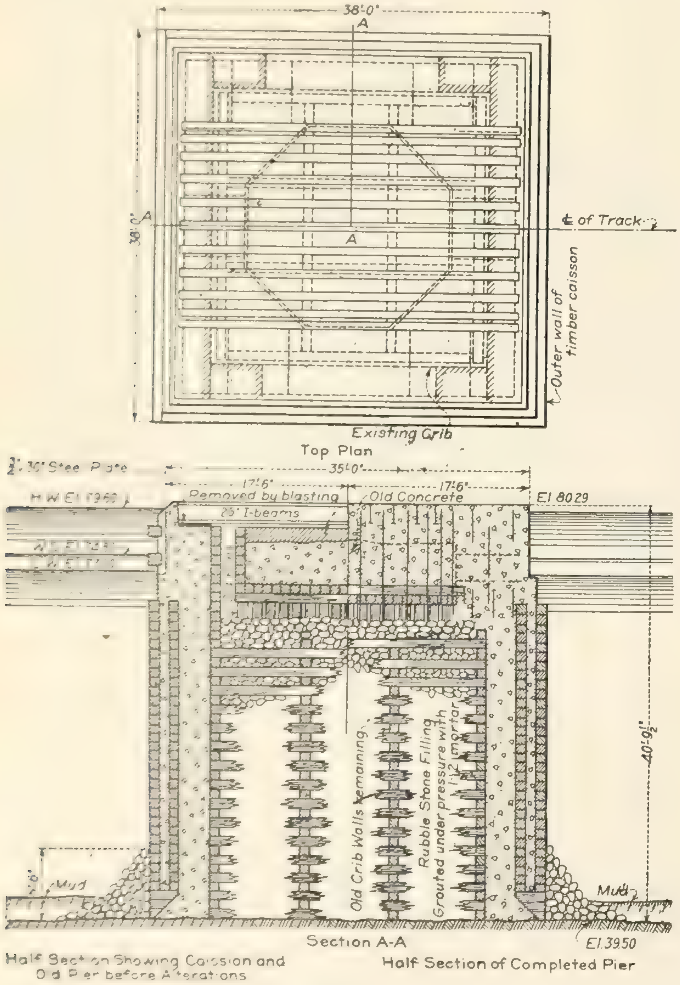


Fig. 1—Plan, half section of old pivot pier and half section of completed pivot pier of Richelieu River bridge.

Substructure.—The new pivot pier was built around the old pier and a new concrete top constructed, the superstructure being supported during construction on steel grillage beams. These beams had for their support the new concrete shell which surrounded the old pivot pier. The open caissons used in constructing the pivot pier and seven of the twelve remaining piers, including the two rest piers, had double walls consisting of 10 x 10-in. timbers, the two parts of each wall being separated by 12-in. vertical timbers resting on a heavy shoe. These caissons were sunk by filling the 12-in. space in each wall with concrete and by adding other loads. The caissons used for the other five piers were also of the open type, but they had single walls consisting of 10 x 10-in. timbers. These caissons were sunk by loading them with rails. The two abutments required timber cofferdams.

The old pivot pier consisted of a timber crib 26 ft. square and 33 ft. high, filled with rubble stone, which surrounded the 108 piles. These piles were capped with a timber grillage, which was 3 ft. below low water and which supported a concrete top 8 ft. high and 20 ft. in diameter. A timber wall surrounded the concrete top, and the space between it and the crib was also filled with rubble stone. As this pier was considered too unstable for the loads which would be thrown upon it by the new bridge, it was reinforced in the following manner:

A double-wall caisson, 38 ft. square, outside dimensions, built up of 10 x 10-in. horizontal timbers and 12 x 12-in. vertical timbers between the walls at intervals, was sunk around the old pier, leaving a 3-ft. space between it and the old crib. After this space was filled up to approximately 6 ft. below low water with plain concrete, reinforced concrete walls were carried up to the required level to receive the eleven 26-in., 166-lb. I-beams, on which the swing span was erected and operated during the completion of the piers. Fig. 1 gives a plan, a half section showing the caisson and the old pivot pier before alteration, and a half section of the completed pivot pier.

It was originally intended to remove the rubble stone filling from the old crib one pocket at a time, but this was found to be impracticable owing to the existence of fissures in the slate-rock foundation, which made unwatering impossible. The stone was, however, taken out to a level 2 ft. below the old timber grillage. The old piles, the timber grillage and the concrete top were left in place, except the upper 18 inches of the latter, which were removed by blasting. Instead of unwatering the pier, water was pumped into it until a 3-ft. head was produced, this head being utilized in forcing a 1:2 grout into the voids of the rubble stone. After the voids were filled the water was pumped out, and the concrete work was completed in the dry, grillage beams being embedded in the coping to distribute the loads from the swing span.

Seven of the intermediate piers have caisson foundations, which are of similar construction to that used for the pivot pier and which differ only in shape. These piers are pointed, both on the upstream and downstream ends. Fig. 2 (a) shows a half cross section and a half end elevation of a typical intermediate pier and caisson in which the double-wall type of caisson was used; Fig. 2 (b) shows a side elevation of the pier and caisson; and Fig. 2 (c) shows a plan of the caisson. Above elevation 70 (the top of the permanent caisson) the construction for all of these piers is alike. The respective heights of the seven piers, from foundation to base of rail, are: Pier No. 4, 29 ft.; pier No. 5, 34 ft. 6 in.; pier No. 6, 37 ft.; pier No. 7, 39 ft.; pier No. 9, 41 ft. 6 in.; pier No. 10, 39 ft. 6 in.; and pier No. 11, 41 ft. The tops of these concrete piers have a length of 16 ft. and a width of 9 ft. From the top of each pier, at elevation 80.5, down to elevation 72.5 (which is 6 in. below low water level) the downstream face is vertical, while the upstream face is bevelled and is reinforced with a 15 x ½-in. plate. Below elevation 72.5 each pier has a width of 13 ft., and a length of 40 ft. 1⅞ in. Originally it was intended to make the length of the rest piers, Nos. 7 and 9, 36 ft. long and 10 ft. wide, but it was finally decided to make the dimensions of all piers requiring double-wall caissons the same. The caissons for these piers have an outside width of 15 ft. and an outside length of 43 ft. The upstream nose forms an angle of 90 deg., while the downstream face makes an angle of 60 deg. The outside 10-in. timber walls are carried up to elevation 76.0, and the inside walls to elevation 70.0. After these piers were completed the outside walls were removed down to the 70.0.

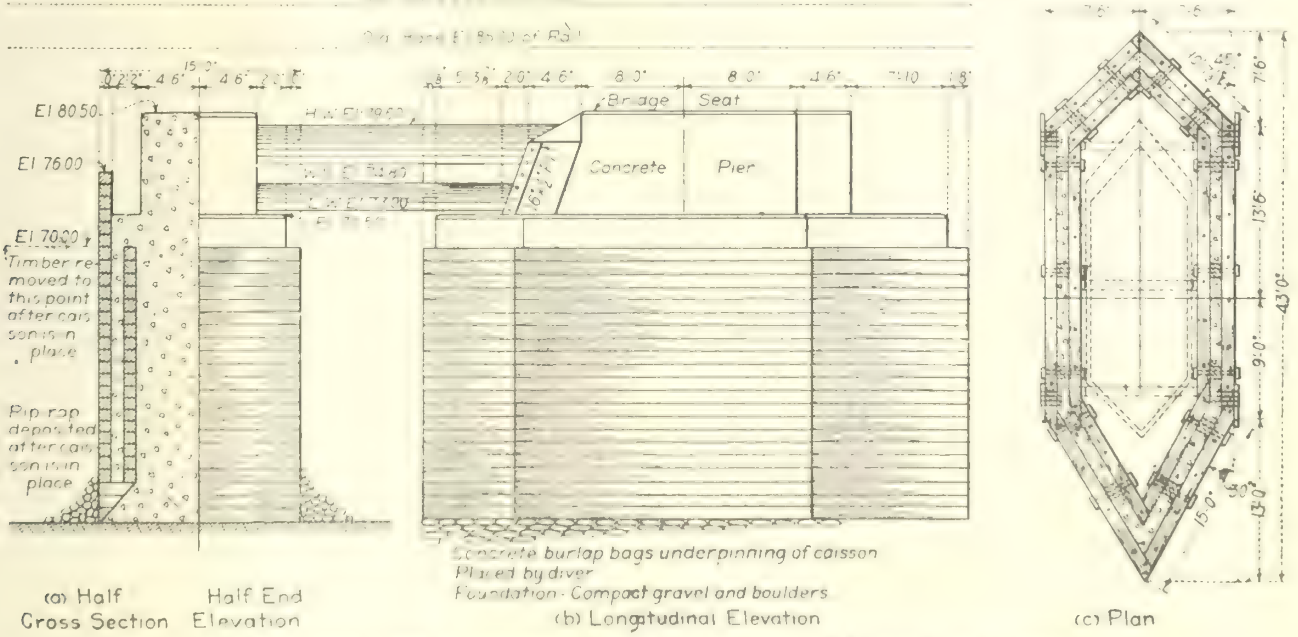

El 80.50
El 76.00
El 70.00
Timber removed to this point after caisson is in place
Rip rap deposited after caisson is in place
15' 0"
4' 6"
8' 0"
Bridge Seat
Concrete Pier
Concrete burlap bags underpinning of caisson Placed by diver
Foundation - Compact gravel and boulders
7' 6"
13' 6"
43' 0"
9' 0"
13' 0"
15' 0"
30°
(a) Half Cross Section
Half End Elevation
(b) Longitudinal Elevation
(c) Plan

Fig. 2—Details of typical intermediate pier and double-wall caisson of Richelieu River bridge.

The five single-wall caissons (Nos. 1, 2, 3, 12 and 13) are similar in shape to that shown in Fig. 2, the piers for which these caissons are being used being located in comparatively shallow water. Fig. 3 shows details of these piers and caissons. The elevation of the tops of these piers is 80.5, while the elevations of their bottoms are: pier No. 1, 65.17; pier No. 2, 64.34; pier No. 3, 62.66; pier No. 12, 61.83; pier No. 13, 66.0. After these piers were built the caisson walls were removed down to elevation 68.5.

The caisson shoes were constructed on land and were launched from a skidway. The caissons were built up in place.

Fig. 4 (a) shows a plan of the east abutment; Fig. 4 (b) shows a longitudinal section along the centre line of the abutment; and Fig. 4 (c) shows a cross section of a wing wall.

In general the piers rest on slate rock, hardpan or compact gravel, except piers Nos. 12 and 13 and the east abutment, which required pile foundations. The compact material under pier No. 11 was overlaid with about 7 ft. of loose material, which was removed by an orange-peel bucket. Before the piles were driven for piers Nos. 12 and 13 about 5 ft. of the top soil was removed. Before placing concrete, a diver levelled off the foundation for each pier and also for the protection works. In addition to this work the diver, who was employed continuously on the job, assisted in landing the caissons, in blasting boulders from the cutting edge, and in blasting away the old crib protection works.

After the caissons reached bottom they were underpinned with burlap bags of concrete and were then filled with concrete, which was deposited by bottom-dump buckets. The water was then pumped from the caisson and the concreting continued in the dry.

The rest piers and the pivot piers were started after navigation had closed, and the work was sufficiently advanced to permit the swing span to be erected in time for the opening of navigation. Some severe weather was encountered, and the temperature was as low as 28 deg. below zero when the upper part of the pivot pier was concreted.

All of the protection piles and cribs of the old bridge required replacing, the new work consisting of six cribs built of 10 x 10-in. timbers and loaded with rubble stone. The three cribs near each rest pier are connected and are joined to the rest pier by floating booms. These booms consist of 12 x 12-in. vertical timbers bolted to the cribs and rest piers. The old centre protection work below low water was left in place, and, after being strengthened by the addition of five new cribs, a new top, consisting of a double row of walings, was constructed.

Superstructure.—The bridge, which is a single-track structure, was designed for Cooper's E 50 loading. The unit stresses used are those given in the 1910 specifications of the Grand Trunk Railway, the impact allowances being those given in the Dominion Government's 1908 specifications. The twelve [illegible] plate girder spans possess no unusual features.

The swing span has a length, centre to centre of end floor-beams, of 244 ft. 7½ in., and a centre height, centre to centre of chords, of 36 ft. It is of the centre-bearing type, the ends being raised and lowered by wedges operated by hand power. The trusses of the swing span are spaced 18 ft. on centres, each truss consisting of eight 28-ft. 6-in. panels and a centre panel having a length of 16 ft. 7½ in. The distance from top of pivot pier to base of rail is 11 ft.

Instead of using concentrated wheel loads in computing the stresses in the swing span equivalent uniform loads were used. The equivalent uniform load used for one arm was 6,400 lbs. per linear foot, and that for the entire span, 5,700 lbs. per linear foot. The dead load assumed for this span was: floor, 735 lbs. and steel, 2,365 lbs., a total of 3,100 lbs. per linear foot.

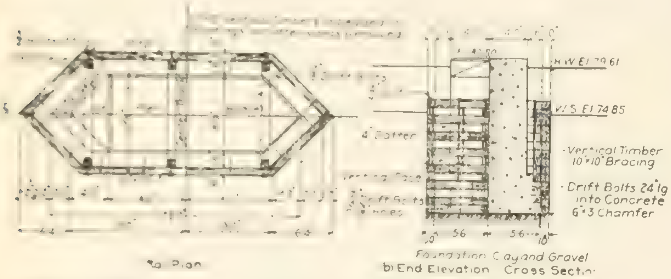

H.W. El. 79.61
W.S. El. 74.85
4" Batter
Vertical Timber 10"x10" Bracing
Drift Bolts 24" lg into Concrete
6"x3" Chamfer
Foundation Clay and Gravel
(a) Plan
(b) End Elevation
Cross Section

Fig. 3—Details of pier and single wall caisson used in shallow water—Richelieu Bridge.

The following cases were considered in determining the stresses in the trusses:

Case I.—Dead load, bridge as cantilever.

Case II.—Dead load, bridge on three supports.

Case III. (a).—Live load, bridge on three supports, loads at b. c. and d.

Case III. (b).—Live load, bridge on three supports, loads at c and d.

Case 111. (c).—Live load, bridge on three supports, load at d.

Case III. (d).—Live load, bridge on three supports, loads at b and c.

Case III. (e).—Live load, bridge on three supports, load at b.

Case IV.—Live load, bridge on three supports, fully loaded.

Case V.—Live load, bridge as simple span, one arm on two supports.

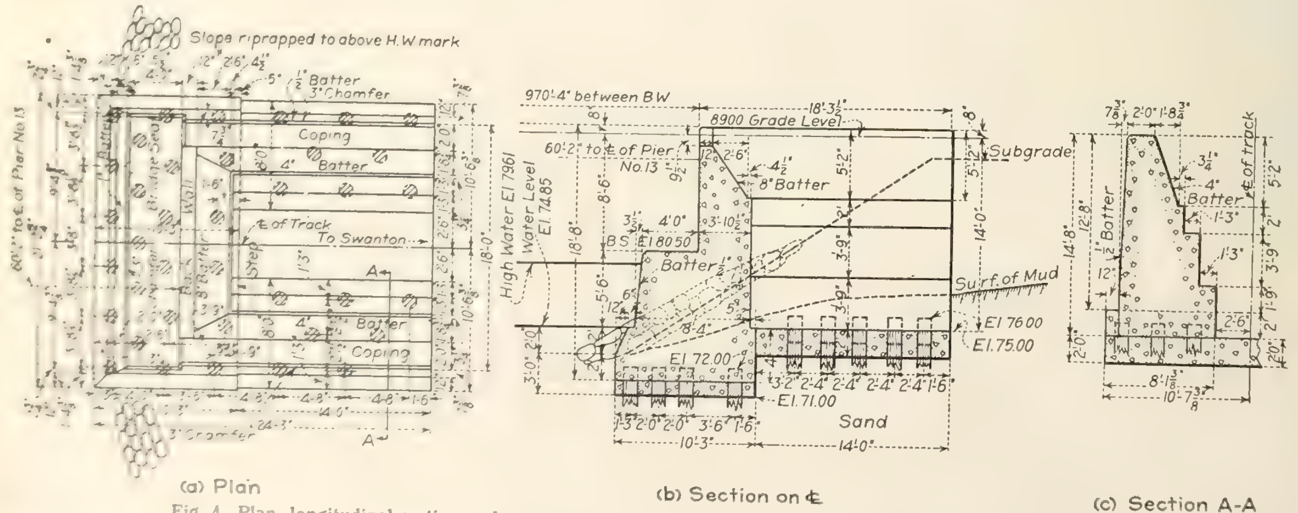
Fig. 5 shows an outline of the trusses of the swing span, and gives the stresses in the truss numbers, and their composition.

The circular girder, which has a diameter of 18 ft., consists of four 6 x 4 x ⅝ in. angles and a 24 x ¾ in. web. The wheels are 12 in. in diameter and 8 in. wide. The centre bearing steel casting is the Grand Trunk Railway's patent No. 11,283.

The 60-ft. plate girder spans were erected, completely rivetted, by means of a derrick car. The twelve girder spans were erected in 5½ days, the traffic having been diverted during their erection.

The Cyclone, the first of two large dredges to be built for harbor improvement work at Toronto, was launched recently from the Polson Iron Works. Although this dredge is surpassed in size by some of the dredges used in constructing the Panama Canal, it is said to be the most powerful dredge in the world. It has been built for the Canadian Stewart Company, which has the contract for improving the harbor of Toronto, a work requiring the removel of some 35,000,000 cu. yds. of sand from the bottom of the harbor to the Ashbridge Bay district, which is being reclaimed for an industrial area. It is understood that the Cyclone has the capacity for handling 15,000 cubic yards a day. The length of this dredge is 170 ft. and the width 42 ft. Steam is furnished by 4 Babcock boilers of a semi-marine type. At the end of the ladder, which is 100 ft. long, is a boring machine that weighs 50 tons. By means of a long stick of Pacific Coast fir swung at the opposite end of the dredge, the suction pipe can operate in a channel 500 ft. in width. The boring mechanism is operated at the end of the suction line by a 500 h.p. engine. The pump in the middle of the dredge, which is worked by an engine of 1,750 h.p., can handle very large boulders. The dredge is equipped with a pipe line more than a mile in length.

Swimming pools with sand filters and movable bulkheads have been proposed by Prof. W. S. Franklin, of the Lehigh University. The object is to let the bulkhead push the used water in the pool into the filter, while back of it the pool is refilled with pure water. The bulkhead is built so that it automatically scrubs the bottom and side walls of the pool.



(a) Plan

(b) Section on ℄

(c) Section A-A

Fig. 4—Plan, longitudinal section and cross section of wing wall of east abutment of Richelieu River Bridge.

Concrete Road Construction

By H. J. Kuelling†

WHILE there are several isolated cases of concrete roads that are fairly old, the pavement is a type that is quite recent and has had a phenomenal growth within the last five years. Naturally with such a growth, there have come about changes in the opinions of engineers relative to the best practices. Without a doubt there will be many great changes before the standards are unified and many of the things we are now doing will be looked back upon as rather poor engineering.

Roadbed.—As in all forms of road construction, the roadbed for a concrete road is almost as important as the wearing surface itself. However, because of the rigid nature of the pavement, I believe that the roadbed can be of poorer quality for this form of road construction than that in any other form that I know of. This does not mean that I recommend the neglecting of proper preparation of the roadbed, but as engineers know, in preparing a road in very dry weather, springy and spongy places are sometimes overlooked and in the cases of non-rigid roads these places will show up at some future date, whereas with a concrete road I believe that the slab often bridges these places and no serious results come about excepting a possible cracking of the road. I think a little too much attention has, perhaps, been paid to thorough rolling of the sub-grade rather than to the thorough destruction of the old road surface in order to have a sub-grade of uniform density under the new road. In my own work we did practically no rolling other than that accomplished by traction engines drawing the graders, or, in a few cases, by tractors hauling material.

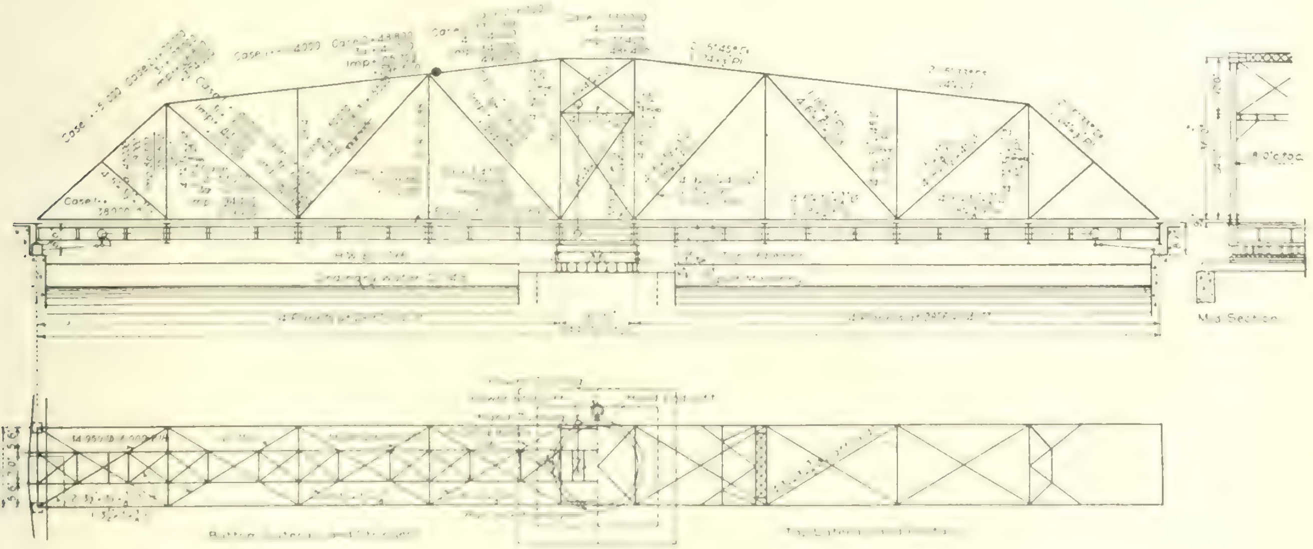


Fig. 5—Stresses and composition of truss members of new swing span of Richelieu River bridge.

Width and Thickness.—This is a subject that has given rise to a great deal of discussion. My personal practice is to use a flat sub-grade, with fairly deep ditches alongside the road to care for drainage. My experience has been that where there is a motor traffic of a thousand or more vehicles every day, an eighteen-foot road is none too wide. With only a few hundred a day, a sixteen or possibly a fifteen-foot road might be ample. In connecton with the width we must consider the ever-increasing amount of reckless driving occurring upon our highways.

The thickness that I am using on our roads, which are sixteen and eighteen feet in width, is six inches at the edges and eight inches in the middle. I believe the thickness will ultimately partly determine by degrees the density and homogeneity that we are able to obtain in our concrete. I believe this because the homogeneous concrete will have an even wear similar to good sandstone and that an increased thickness will merely mean an increased life of the road.

Cement.—Getting the proper amount of cement into the road is, I believe, one of the difficult things to accomplish at the present time, especially where the contractor is inclined to be negligent. This is overcome largely in my county by furnishing all cement delivered to the contractor on the job. In this way he has no tendency to slight the proper amount. On the other hand, we hold him responsible within certain degrees for an over-run of cement and also make him responsible for the care of all empty sacks.

I believe that all cement for road purposes should be given thorough testing by reliable engineers. My opinion in this matter has been proved by the fact that we were compelled to reject a considerable number of cars of cement during the past season.

Coarse Aggregate.—In a few words, the better the quality of the aggregate, the better the quality and the longer the life of the road. In all forms of road construction it is a question of Cost versus Economy. The high-priced aggregate is sometimes more economical than the low-priced local material. We prefer a stone graded from one-quarter inch to about one and one-half inches, and of course demand that it be clean and free from any slate, shale or disintegrated stone. In our state, we limit the coarse aggregate to material having a French coefficient of wear of ten or over.

Fine Aggregate.—Our specifications for fine aggregate read as follows:-

> "Fine aggregate shall consist of clean, sharp sand of silica or hard silica rocks, and shall not contain over three per cent. of clay or loam. The fine aggregate shall have a reasonably uniform graduation from a size which will pass through a one-quarter inch screen down. Sand containing an appreciable per cent. of flat flakes shall not be used. Fine aggregate other than the above may be used only upon the approval of the engineer."

Pit Run Gravel.—In no case would I permit the use of pit run material in the concrete road.

Proportions.—I believe that too often the proporthat are specified more or less blindly. It should depend absolutely upon the quality of the material obtainable. This necessitates a careful study of the voids and the make-up of the gravel or stone that might be used. The uniformity of mixing is as important almost as the amount of cement demanded. The proportions should be those that will give the greatest density and most homogeneous concrete as can be obtained with the sand and stone obtainable. If the addition of hydrated lime or some other inactive material will tend to assist in obtaining these results without lowering the abrasive value of the concrete, it should be included in the proportions. There is a wide field open for careful experiments along this line. Personally I hope to make some abrasive tests in the near future on different mixes containing hydrated lime. At the present time I am using a mix of 1:2:3½, but I would not say for a moment that this is the proper mix for all parts of the country.

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*Paper presented at the Chicago Convention of the American Road Builders Association.

† County Highway Commissioner of Milwaukee County, Wisconsin.

Reinforcement.—It is in exceptional cases only that reinforcement is necessary in a country road, these cases being only when springy spots are encountered, or possibly where sufficient drainage is impossible due to the swampy nature of the territory.

Mixing.—The proper amount of mixing is another matter that is open for discussion. The point most commonly overlooked is the nature of the machinery. Five turns with some mixers are as good as ten with others. The amount of mixing should depend upon the shape of the individual pieces in the aggregate and also to a certain extent upon the gradation. In determining the number of turns a mixer should be given, careful watch should be paid to the speed of the drum.

Placing.—For road work proper, I prefer a spout to a boom. The main reason for this is that the material is deposited in smaller quantities—with, therefore, less tendency toward separation of the aggregate and mortar. Very commonly the boom bucket leaks and unless careful watch is maintained there is a pile of mortar left at each moving of the machine. Further the boom is additional weight to be carried around and is often the cause of delaying the work.

Finishing.—If the concrete is maintained at proper consistency, which is such that it will flow fairly easily in place and not run like water, very little finishing is required. One man can easily keep up with a good-sized crew, and about all that he should do is to smooth out the markings of the strike-off board and remove any foreign matter, such as sticks, coal or clay, which will always float to the surface. The finisher should use a wooden float at least eighteen inches in length and keep a sufficient distance back of the mixer, so that the concrete is about ready for its initial set.

Curing.—The first step in curing is to sprinkle the sub-grade in dry weather. We find this is best accomplished by the fireman connecting a small hose to the injector. The next step in curing is to protect your road with canvas in case the temperature is over ninety degrees or in case the weather is exceedingly dry and windy. When sufficiently hard the concrete should be sprinkled and covered with about two inches of earth from the side of the road and then kept wet (not in a moist condition) for about ten days.

Joints.—The question of joints is the most unsettled one in connection with concrete roads. We have increased our joint spacings from twenty-five to thirty-five feet and from thirty-five to fifty feet and at the present time I see no reason for shortening the spacing. I doubt very seriously the need for steel protecting-plates, for no matter how carefully they are placed there is a tendency to chip, thus demanding an almost immediate tarring of the joints. I believe that the joints of the future will be merely felt or paper with a slight rounding of the joint, with an edging tool, which will be filled in by the pounding down of the felt which has been permitted to stick up above the surface. I believe that the ability to get concrete that is homogeneous and impervious to water, will have a marked effect upon the spacing of joints as water content is more the cause of the movement in concrete than the changes in temperature.

Shoulders.—After trying both gravel and earth shoulders we have practically come to the conclusion that for double track roads, earth shoulders are preferable. We have found that it is not necessary to bevel off the edges of the concrete in order to make the shoulders stay in place, and now we merely round the edges to about a one-inch radius.

Inspection.—This article would not be complete without a word regarding inspection. If there is a type of road that demands thorough inspection it is a concrete road, as mistakes cannot be remedied the day following. The inspector should be a man of judgment who appreciates to the utmost the importance of detailed work. He should be a man of considerable "back bone" and one who has no political connection with the work.

Conclusion.—While concrete, in its present form, has some disadvantages, I believe that it now meets the modern traffic conditions as economically as any form of pavement known. Also, I believe that the next few years will bring about a quality of concrete and form of construction that will make a country road having a very lengthy life from a road standpoint, especially if the traffic conditions continue to change in the present direction.

Fish ponds of sewage are provided for Bergedorf, Germany, a suburb of Hamburg, inasmuch as the town is removed from any large stream and the effluent from the Imhoff tanks and sprinkling filters is not considered complete enough to turn into the small watercourses. Dr. Edward Bartow, in a recent paper presented before the Illinois Section of the American Waterworks Association, stated that satisfactory results were obtained without dilution. Purification is effected by water plants that make the ponds suitable for fish culture. Carp less than 6 ins. long grow to a length of 18 ins. in a single summer. The flesh is good if the fish are transferred to pure water for a few weeks before they are eaten.

Working drawings on limp linen are used for all field work on the new Welland Ship Canal now being built between Lakes Erie and Ontario. Those drawings which are apt to be needed in the field are printed, brown or black on white, after the so-called Vandyke process, on ordinary white linen, and are then colored if desirable, to indicate any peculiar conditions. These linen sheets can then be crumpled into any convenient shape and carried, without much regard to their folding, in pocket or bag. They have proved very useful no account of their long wear, their freedom from creasing, and the ease with which they can be held and studied in wind or rain. When dirty they can be washed and ironed the same as a linen handkerchief. As a rule they are printed in the regular 24 x 36-in. size. The method was introduced by Mr. J. L. Weller, engineer-in-charge of the canal.

Examples of Estimating Methods Practised by English Contractors

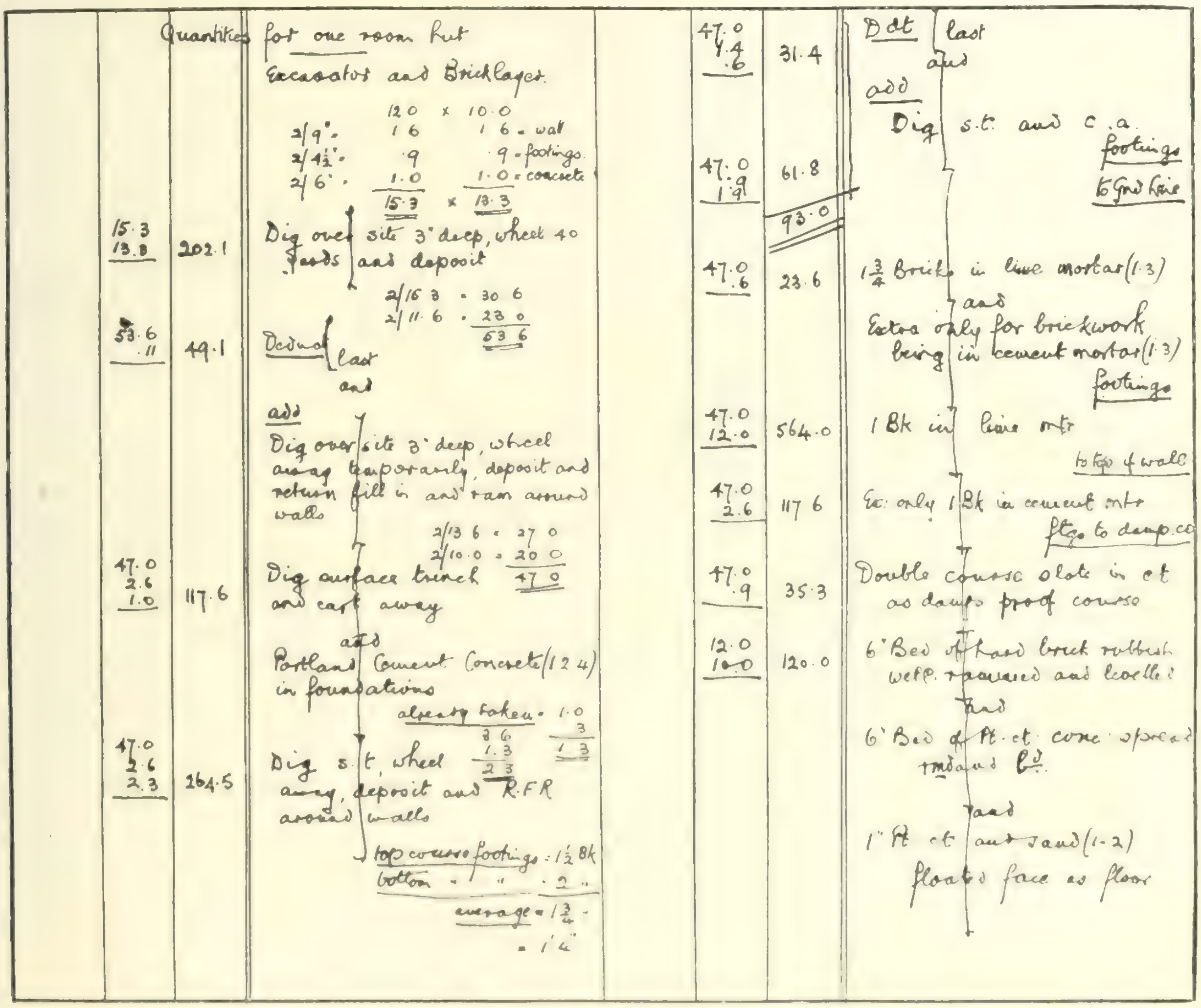
By G. Metson†

THE method of taking off quantities on the London System is here shown by means of a simple example. As there is some small difference in nomenclature between English and American technical terms, the words in the "taking off" have been written at first in full, but the professional quantity surveyor adopts accepted abbreviations, so that the work of taking off is very rapid. Where a word appears a second time in the quantities given, the abbreviated form has been used.

In the second column are entered the "dimensions." In the fourth the "description." The third column is used for "squarings," whilst the first is used for "timesing"—in which a stroke means "times" or multiply and a dot means "add on." The figuring and words underlined on the right hand side of the description column is known as "waste," i.e., it is information showing how the dimensions are arrived at and where they are for. Waste items are of great use at the time of adjusting variations at the end or during contracts.

Where there are three rows of figures to one dimension it shows an item of work that is billed in cubic yards. Two rows show one billed in square yards or squares (100 feet superficial). One row of figures shows an item billed per foot run. How to know in what manner to book a dimension is best learned by studying the easiest way to price the particular description of work, e.g., excavation is billed in cubic yards as it is easily known how long it takes to excavate a cubic yard and also how many carts are required to cart away the total yards billed; again, timber for construction is bought by the load of 50 cubic feet in London, hence joists, rafters, plates, etc., are billed in cubic feet; again, flooring is billed in squares, as the contractor purchases his flooring in that denomination. In American practice these denominations may differ, when the method of booking a dimension—cubic, superficial or lineal—can be altered to suit the prevailing method of pricing or purchasing materials, leaving them in the denomination in which they are most easily priced.

After all the "taking off," i.e., booking the dimensions, is completed, the items are squared (third col



		Quantities	for one room hut
			Excavator and Bricklayer
			12 0 × 10·0 2/9" = 1 6 1 6 = wall 2/4½" = ·9 ·9 = footings. 2/6" = 1·0 1·0 = concrete 15·3 × 13·3
	15·3 13.3	202·1	Dig over site 3" deep, wheel 40 yards and deposit
			2/16 3 = 30 6 2/11·6 = 23 0 53 6
	53·6 ·11	49·1	Deduct last and
			add Dig over site 3" deep, wheel away temporarily, deposit and return fill in and ram around walls
			2/13 6 = 27 0 2/10·0 = 20 0 47 0
	47·0 2·6 1·0	117·6	Dig surface trench and cart away and Portland Cement Concrete (1 2 4) in foundations
			already taken = 1·0 3 6 3 1·3 1 3 2 3
	47·0 2·6 2·3	264·5	Dig s.t., wheel away, deposit and R.F.R around walls
			top course footings = 1½ Bk bottom " " = 2 " average = 1¾ " = 1' 4"
	47·0 1·4 ·6	31·4	Ddt last and add Dig s.t. and c.a. footings
	47·0 ·9 1·9	61·8	to Grd line
		93·0	
	47·0 ·6	23·6	1¾ Brick in lime mortar (1·3) and Extra only for brickwork being in cement mortar (1·3) footings
	47·0 12·0	564·0	1 Bk in lime mtr to top of wall
	47·0 2·6	117 6	Ex: only 1 Bk in cement mtr ftgs to damp.co
	47·0 ·9	35·3	Double course slate in ct as damp proof course
	12·0 10·0	120·0	6" Bed of hard brick rubbish well rammed and levelled and 6" Bed of Pt. ct. conc. spread and ld. and 1" Pt ct and sand (1-2) floated face as floor

Sheet giving the various dimensions

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*Extract of article published in a recent issue of Building Age.

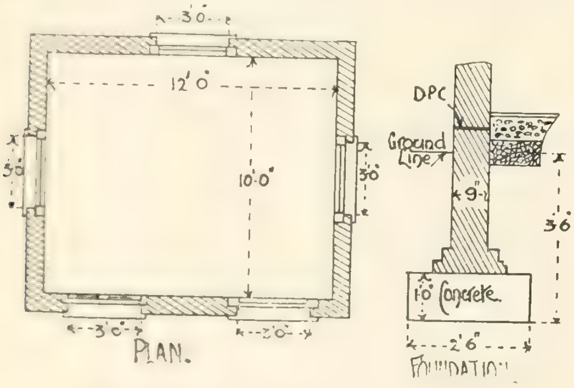
†Licentiate of the Royal Institute of British Architects; Lecturer on Quantity Surveying at the Borough Polytechnic School, London.

[illegible], when they are abstracted, the dimension item being scored through as each item is entered in the abstract.

When the abstract is complete, the bill is merely a fair copy of the totalled or "reduced" abstract, and again the items on the abstarct are scored through as each one is entered in the bill.

The taking off, abstract and bill are given in manuscript form in order to show style and method of preparation.

In the example of taking off the waste clearly shows how the 15 ft. 3 in. x 13 ft. 3 in. digging over the site is made up. The second item is for the excess measured in the first one, for the portion that has to be returned to the outside of the walls. The third dimension is for the digging to that portion of the trench occupied by the concrete, so that the one dimension is used for the description of both "digging" and "concrete," the two being separated by the word and, the use of which avoids the writing of the dimension down again for the concrete. The fourth dimension is for the surface trench from the top of concrete to ground line. Obviously the portion of earth in the trench that will be occupied by the footings and wall cannot be returned, so the adjustment is made on the sixth dimension for the footings portion, and the seventh dimension adjusts it for the wall portion.



Plan and section of building used as example.

In order to save a lot of dimensions and their consequent squaring and abstracting, footings are averaged for brickwork. The majority of the brickwork is in lime mortar, so that all is taken in lime mortar, and the small portion (up to damp course) that is to be in cement mortar is measured as "extra only for being in cement mortar." The other dimensions call for no comments.

In the abstract each trade commences with cubic items, followed in turn by superficial, lineal and number ones. This order is always kept to. The item when ready to go to the bill has two lines placed under under it—and before the bill is written the abstract is checked again and ticked by the checker.

As all items in the squaring columns are in feet and inches, when they got totalled up on the abstract they are "reduced," i.e., divided by 27 for cubic items, 9 for superficial ones, and for brickwork by 272 to bring it to rods, etc.

Anything under half a foot is ignored. Half or over is counted another foot, so that the item for foundation concrete becomes 4 yd. 12 ft. and not 4 yd. 11 ft., whilst the first item on the abstract remains at 6 yds. 9 ft. and not 6 yds. 10 ft.

Excavation over 12 ins. deep is billed in yards cube, and 12 ins. deep or under (being the top soil and generally useful for garden purposes) is kept separate in yards superficial.

Brickwork in London is billed in rods of reduced thickness, i.e., 1½ bricks thick—a rod equals 272 ft. super. or 16½ ft. x 16½ ft.

System is essential to ensure that there is no duplication, or omission of any items. It must be admitted that the example shows a sure method of arriving at the quantities of work shown in the illustration. The walls are taken solid, without deductions for doors ors windows. These deductions will be made under other sub-heads, viz., "external openings" and "doors and windows."

All other sub-headings of work as "roofs," "windows," "doors," etc., are just as simply taken on in the London system as the present example of the subheading "excavation and brickwork," and each subhead is clearly defined, so that one does not overlap the other.

Specifications

Dig over a site to bottom of hard brick rubbish, and deposit earth 40 yards away from the hut.

The concrete to be composed of one part cement, two of clean river grit and four of clean ballast.

The brickwork to be in lime mortar (1-3) except up to damp course level, which is to be in cement mortar (1-3).

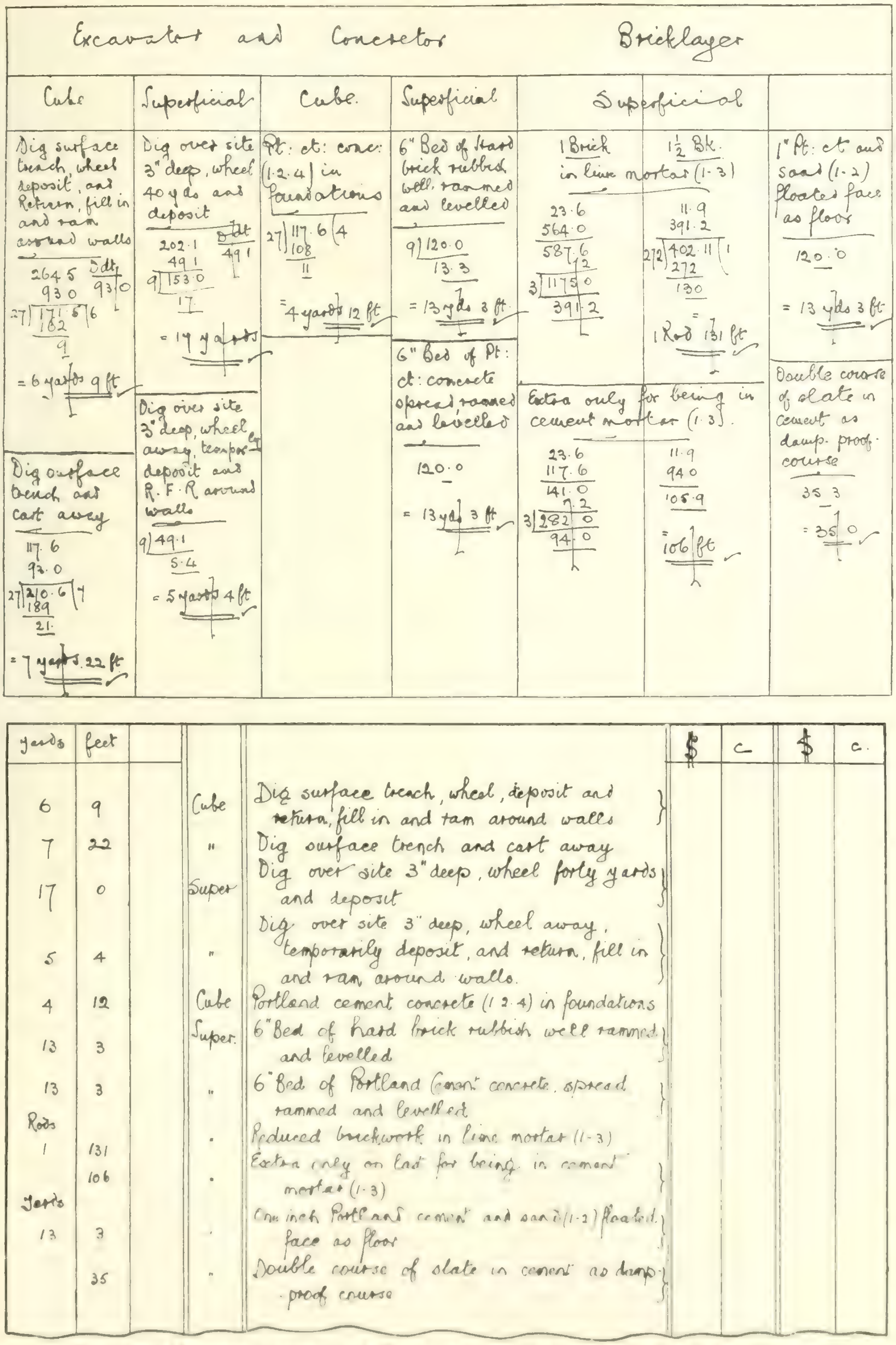
The walls are 10 ft. high above ground line.

The damp course to be a double course of slate in cement.

The cement concrete over site to be faced with one inch of Portland cement and sand (1-2).

In connection with the walls of a brick building it was desired to clean and brighten the terra-cotta dressings, the bricks being of a deep tan color, while the terra-cotta was of a light cream that had turned dark and was unsightly from many years' exposure. The "Painters' Magazine" says: "The simplest way to accomplish this is to mix 2 lb. of powdered pumice and 1 pint of liquid ammonia with 1 gal. of soft soap, applying the mixture to the surface to be cleaned with a fibre wall-brush, allowing it to remain about thirty minutes. Then rub briskly with a good scrubbing-brush. When on trial it shows that the compound has done its work, clean it off with lukewarm water by using a large sponge, and rinse, if possible, with a hose, otherwise with the sponge and a liberal supply of clear water. If after drying the terra-cotta appears dull it may be revived by rubbing it over with a cloth saturated with kerosene oil."

It has been found advisable in the highway work carried on in King County, Washington, to build the curves on brick pavements without crown. The usual super-elevation now being used on curves is about twice the crown prescribed for any given width, while the maximum super-elevation is 1 ft. for a 20-ft. roadway. The amount of super-elevation is not determined by the length of the radius, but rather by a number of other conditions, chief among which is the width of central angle. Owing to the fact that automobiles usually "cut corners" on a short curve, they swing around it on a larger radius than the centre line actually has, so that the super-elevation required on a short curve is less than that needed for one with a greater central angle. No drainage difficulties have been reported, and there is a general agreement among motorists that the elimination of crown makes the curve safer and easier to drive over at high speed.



Excavator and Concretor				Bricklayer		
Cube	Superficial	Cube.	Superficial	Superficial		
Dig surface trench, wheel deposit, and Return, fill in and ram around walls 264.5 Ddt. 93.0 93.0 27)171.6(6 162 9 = 6 yards 9 ft	Dig over site 3" deep, wheel 40 yds and deposit 202.1 Ddt. 49.1 49.1 9)153.0 17 = 17 yards	Pt: ct: conc: (1.2.4) in foundations 27)117.6(4 108 11 = 4 yards 12 ft	6" Bed of hard brick rubbish well, rammed and levelled 9)120.0 13.3 = 13 yds 3 ft	1 Brick in lime mortar (1.3) 23.6 564.0 587.6 2 3)1175.0 391.2	1½ Bk. in lime mortar (1.3) 11.9 391.2 272)402.11(1 272 130 = 1 Rod 131 ft	1" Pt: ct and sand (1.2) floated face as floor 120.0 = 13 yds 3 ft
Dig surface trench and cart away 117.6 93.0 27)210.6(7 189 21 = 7 yards 22 ft	Dig over site 3" deep, wheel away, tempor-ily deposit and R.F.R around walls 9)49.1 5.4 = 5 yards 4 ft		6" Bed of Pt: ct: concrete spread rammed and levelled 120.0 = 13 yds 3 ft	Extra only for being in cement mortar (1.3). 23.6 117.6 141.0 2 3)282.0 94.0	Extra only for being in cement mortar (1.3). 11.9 94.0 105.9 = 106 ft	Double course of slate in cement as damp-proof course 35.3 = 35.0

yards	feet				$	c.	$	c.
6	9		Cube	Dig surface trench, wheel, deposit and return, fill in and ram around walls				
7	22		"	Dig surface trench and cart away				
17	0		Super	Dig over site 3" deep, wheel forty yards and deposit				
5	4		"	Dig over site 3" deep, wheel away, temporarily deposit, and return, fill in and ram around walls.				
4	12		Cube	Portland cement concrete (1.2.4) in foundations				
13	3		Super.	6" Bed of hard brick rubbish well rammed and levelled				
13	3		"	6" Bed of Portland Cement concrete, spread rammed and levelled				
Rods 1	131		"	Reduced brickwork in lime mortar (1-3)				
	106		"	Extra only on last for being in cement mortar (1-3)				
Yards 13	3		"	One inch Portland cement and sand (1-2) floated face as floor				
	35		"	Double course of slate in cement as damp-proof course				

Estimating Methods.—At the top of the page is shown the abstract, and at the bottom what the author describes as the bill

Concreting in Freezing Weather, and the Effect of Frost Upon Concrete

THE engineer who is called upon to carry out work in Canada during the winter finds that the methods of construction which were satisfactory in the summer will need considerable modification to suit winter conditions.

Concrete work, especially the lighter forms of reinforced concrete, used in building construction needs greater care and supervision. As a result of considerable experience gained during the last few years, it can be said that the freezing of concrete will not damage it if it has first had a chance to set under favorable conditions for about two days. The effect of the freezing is simply to delay the process of hardening, which will again proceed under suitable conditions, and will eventually attain its full strength. If concrete is frozen before it has commenced to set, it will not be injured if precautions are taken to prevent it from freezing again after it thaws until it is sufficiently hardened to withstand the affects of subsequent freezings. It is alternate freezing and thawing during the process of setting that causes the damage.

To meet the foregoing conditions, when carrying out concrete work in winter, it is necessary to devise means of mixing the concrete with materials freed of frost, placing it in the forms before it has commenced to freeze, and then protecting it and keeping it warm without fear of its being damaged.

In the case of concrete in mass, of large bulk, it is unnecessary to apply external heat, as the large body of concrete will generate sufficient heat during the process of hardening to enable the mass to set; all that will be necessary is to protect the outside of the concrete so as to keep the heat in. This can best be done by covering the concrete with clean straw.

For light sections of concrete, such as in reinforced concrete, poured at a temperature not below 22 deg. Fahr., some engineers allow salt to be used in a proportion not exceeding 10 per cent. There are many arguments for and against its use. The author prefers not to use it, except in marine works when the concrete is mixed with sea-water and the salt is admitted in that form. He has found that, instead of using salt good results will be obtained for temperatures that do not fall below 22 deg. Fahr. by heating the water with a steam-hose taken from the mixer-boiler, and when necessary placing a few coke or wood fires on the heaps of sand and crushed stone, the usual precautions being taken to protect the concrete when in the forms, as described later.

For lower temperatures than those referred to above greater precautions must be taken to heat the ingredients by means of steam coils or radiators.

The concrete having been mixed, and the portion of the work to be carried out decided upon, the floor immediately below it should be partitioned off with tarpaulins, and coke stoves arranged under the floor slab, allowing about one stove to every 800 sq. ft. of floor space. All loose dirt and snow must be removed from the forms with brooms, and a steam hose should be applied to remove all ice and frost, the steam playing continuously over the forms in advance of the concrete, thus warming them in readiness for the concrete. The concrete should be poured quickly and continuously, and as each section is completed a tarpaulin may be drawn over it, supported on wooden strips about 6 inches above the surface of the concrete. In most cases this protection will be sufficient, but during very cold weather it will sometimes be found necessary to form a sort of tent over the floor, in which extra stoves are placed to protect the workmen and the upper surfaces of the concrete.

Great care must be taken to have the fires kept burning continuously for two days, after which the concrete may be allowed to freeze without fear.

The work must be examined from time to time until it is found to be hardened sufficiently. During summer working the author has allowed the supports from the underside of slabs to be removed in four days, but on other occasions four weeks have not been found to be too long.

There are many examples of concrete works which have stood the test of time without showing any signs of being affected by frost; but, on the other hand, a few cases have been reported of very serious corrosion due to the action of frost, such as bridge piers and reinforced-concrete piles.

Judging from the information available at present, concrete exposed in air in a dry locality need not be affected by frost any more than good building stone, and probably it will stand much better. Concrete always submerged under water is protected and need cause no anxiety. But concrete alternately wetted and frozen must be protected from frost. On work which is being carried out at Halifax, Mr. John Kennedy, M. Inst. C. E., is protecting the concrete piles between high and low water with a covering of wood about 2 inches in thickness, which it is hoped will prevent the action of frost.

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[*] Abstract of paper read at a meeting of the Institution of Civil Engineers, Great Britain, by J. Hammersley-Heenan, Montreal.

The Evils of Indefinite Plans and Specifications

ADVOCACY of definite plans and specifications on either public or private work is no longer necessary, comments the Engineering Record, editorially. In theory it is recognized as desirable to give contractors all the information possible when asking for bids. Quantities should be as definite as possible, and alternative designs permitted only after careful consideration. If alternative plans are permitted, the restrictions should be such that it is possible to compare them.

While this is the theory, contractors cite instances without number of its violation in practice. Two very recent examples in neighboring cities furnish food for thought for those whose invitations to bidders are still indefinite. In the one case tenders were asked for the construction of a $300,000 sewer system. The contract form contained 55 pages of text, covering terms and conditions of the contract and the grade of materials and work required. Then followed a 15-page list of detailed quantities. This list did not attempt to show the amount of cement required, for example, but rather the number of cubic yards of concrete in each different sewer section per lineal foot. It enumerated the exact length of each type and size of sections for various depths and the amount of excavation, timbering and invert paving required on curves and tangents. Quantities in cubic yards were carried out to the third decimal place, and even the exact number of step-irons and their bolts was listed. Opposite each of the items listed there was left a blank in which the contractor was to fill in unit and total prices.

In marked contrast to this it is interesting to note that some time after tenders were asked for this sewer work a neighboring city called for bids on a reinforced-concrete structure for municipal use. There was some debate as to just what type of construction to adopt, so it was decided to leave the specifications somewhat indefinite and allow each bidder to submit his own design. When bids were opened it was found that twelve contractors had turned in a total of one hundred and twenty different tenders, each one for a different design, and all based on estimates which could not possibly have been worked out in fine detail. These tenders varied from $162,000 to $248,000 and, partially because it was impossible to compare them satisfactorily, no final action has yet been taken.

The sewer work, on the other hand, has been under way for several months, the contract having been awarded shortly after bids were opened. After eliminating the highest and the lowest bidders in the sewer work the remaining five tenders were within 12 per cent. of one another, and on one varied more than 7 per cent. from the engineer's estimate.

There will be some criticism of the refinement in the case of the sewer specifications where preliminary calculations worked out concrete yardages per foot to the last thousandth, but such criticism only accentuates the moral in the comparison, for even with this extreme refinement the cost of getting out the specifications was only about one-tenth of 1 per cent. of the work.

B.C. Engineers in Session at Victoria

THERE was a representative gathering at the Third Annual Convention of the Victoria and Vancouver Branches of the Canadian Society of Civil Engineers, held at Victoria on December 11-12. The deputation from the mainland included Messrs. R. F. Hayward, Geo. A. Walkem, E. G. Matheson, A. D. Creer, H. Carry, E. A. Cleveland and J. H. Kennedy—headed by Mr. G. R. G. Conway, Chief Engineer of the British Columbia Electric Railway and Chairman of the Vancouver Branch.

The visitors were received by Mr. D. O. Lewis and Mr. R. W. Macintyre, Chairman and Secretary respectively of the Victoria Branch.

At a business session, held on the evening of Friday, December 11, a paper relating to harbor improvements was read by Mr. J. S. McLachlan, Resident Engineer of the Dominion Department of Public Works.

At the morning session on Saturday, December 12, the Chairman dwelt at some length on the status and responsibilities of the profession. It was gratifying to find that a clause had been inserted in the Provincial Water Act, defining the duties of the civil engineer. This constituted a certain amount of recognition of the profession.

A paper entitled "Legislation for the Engineering Profession" was read by Mr. G. R. G. Conway. In the ensuing discussion Mr. Walkem recalled the opposition encountered sixteen years ago in Manitoba and Quebec. Similar opposition might develop in British Columbia in the event of an attempt to introduce what would be termed "class legislation." Mr. C. H. Rust compared the position of medical men and lawyers. He considered that it would probably be inadvisable for engineers to attempt to form a close corporation. He held, however, that in the interests of the younger members of the profession some effort should be made along the line of a more strict definition of professional engineering status. Mr. Cavana referred to the attitude of the Victoria and Vancouver Branches on the question of legislation. He thought that they were rather opposed to the idea of forming a close corporation, but that they considered the time ripe to ask the legislature for an authoritative declaration as to what an engineer really was. Mr. Gamble held that the profession required only a proper recognition of the meaning of the term "Engineer." He asked that some standard definition should be incorporated in the Interpretation Acts of the province. Mr. Walkem complained of the action of the Eastern provinces in attempting to combine the whole profession and to define all branches of engineering in one term—an impossible task.

Mr. Hayward urged those present to emulate the example of the Institution of Civil Engineers (Great Britain), which had been established in its position of prominence by prestige and precedent. Canadian societies should follow the Old Country example in so treating the ethics and practice of their profession that their work would be placed in the highest classification. Legislation would not effect more than the highest practice of the profession by the members. He agreed with the view that a comprehensive definition of the term "Engineer" was very desirable.

Both Mr. A. D. Creer and Mr. H. Carry advanced a plea for the strict observance of professional etiquette at all times.

Mr. E. G. Matheson alluded to the attitude of the American Society of Civil Engineers on the subject of legislation. While he was in sympathy with the views of previous speakers he felt that an established definition of the profession would produce a feeling of confidence and security when public work was being given out. The public should be trained to believe in the Canadian Socety. On the other side of the line the services of the engineer were being placed on a higher plane.

Messrs. Macintyre, Gamble and Young also took part in the discussion. Mr. Young advocated that an effort should be made to obtain the recognition of the University of British Columbia. He thought that some engineering degree might be adopted by the University Council.

A private business session was held on the morning of Saturday, December 12, while on the afternoon of the same day the members were the guests of Mr. H. A. Elgee, local manager for Sir John Jackson, Limited. A trip was made to the Albert Head Quarries, where the stone for a large new breakwater is being secured. A blast was fired in order that the visitors might note the effect produced by the heavy charge of explosives.

At the annual banquet on Saturday evening the attendance numbered nearly one hundred. The guests included Mr. G. H. Barnard, M.P.; Hon. Dr. Young; Mr. H. H. Watson, M.O.A.; Mr. H. B. Thompson, M.L.A; Mayor Stewart and Col. Oglivie. Letters of regret were received from Sir Richard McBride, Premier of British Columbia, and from Hon. Wm. R. Ross, Minister of Lands.

The following gentlemen, resident in Canada, have been elected to Associate Membership in the American Society of Civil Engineers:—Mr. G. W. Harris, Port Arthur, Ont. (Office Engineer, Mackenzie, Mann & Company, Limited); Mr. C. W. Millard, Vancouver, B.C. (Manager and Chief Engineer for Mr. Francis S. Swales, architect); Mr. L. R. Thomson, Montreal, Que. (Designer, Dominion Bridge Company, Limited).

Personal Mention

Mr. J. S. MacLachlan, Dominion Government Engineer, read a paper on Harbors at a recent meeting of the Victoria Branch of the Canadian Society of Civil Engineers.

Mr. Mercier, the assistant engineer of the Montreal Council, will act as chief engineer during the absence of Major G. Janin, the chief engineer, who has volunteered for the front in command of a corps of engineers.

Mr. Percy E. Jarman has been appointed City Engineer of Westmount, P.Q. Mr. Jarman has been acting engineer for nearly two years. Formerly he was assistant to Mr. Archibald Currie, then City Engineer of Ottawa.

Mr. J. E. Putnam is senior member of the new engineering and architectural firm of Messrs. J. E. Putnam & Company, Indianapolis, Ind. He is associated with Mr. W. C. Thayer, at one time Chief Draughtsman for the General Electric Company, at Peterborough, Ont., and later Assistant Engineer on the construction of the Niagara Falls hydro-electric power plant.

Mr. Fred M. Hoadley, consulting engineer, 802 New Birks Building, Montreal, has been commissioned by the Bishop of the Monastery at Oka, Quebec, to make a complete investigation into the possibilities of developing a hydro-electric plant upon the river running through the property adjacent to the Monastery for the purpose of generating power and lighting.

Mr. A. W. E. Fawkes has resigned as Water-Works Engineer of Calgary, to open an office in the Burns Building, Calgary, as consulting engineer. Mr. Fawkes will specialize in water-works, filtration plant, sewer and other municipal engineering works. He is also prepared to undertake gas, water and electrical appraisal, supervision and inspection. Mr. Fawkes began his engineering experience in England and was for a time assistant engineer for the British Government. Later he was chief engineer of construction for Messrs. Vickers, Sons & Maxim, in England. After coming to Canada, he was engaged in hydro-electrical power development at Campbellford, Ont., resident engineer for the city of Peterborough, Ont., on dam, pumping station and water-works construction, chief assistant engineer of construction on the Minneapolis filtration plant, engineer in the Bridge Department of the Chicago, Milwaukee & St. Paul Railway, and Water-Works Engineer at Calgary. Mr. Fawkes is a Member of the Institution of Municipal Engineers, the Institution of Engineers, the Institution of Water Engineers, the Institution of Municipal and County Engineers, all of England, and also of the American Water-Works Association and the International Congress of Engineering.

Mr. A. J. T. Taylor, for two and one-half years a member of the firm of Taylor & Young, Limited, engineers, Vancouver, recently severed his connection with that firm to become Managing Director of the Taylor Engineering Company, Limited, engineers and machinery merchants, with offices in the Vancouver Block. The firm, which is backed by ample local capital, will specialize in pumping and power plant equipments of the best types, which will be designed, tested and handed over under guarantee. The new firm has already taken on several good-sized contracts, and will be heard from later on when returning prosperity sets the wheels of industry moving.

"The Business Ethics of the Engineer" was the subject of an address delivered recently before the Engineering Society of Queens University, Kingston, by Mr. G. G. S. Lindsey, K.C., President of the Canadian Mining Institute.

Canadians in Chicago

The following were among the Canadians in attendance at the convention of the American Road Builders' Association, held in Chicago, December 14-18:—Mr. J. K. Allen, Toronto (General Manager, Rocman Roads Company); Mr. E. H. Armstrong, Halifax, N.S. (Minister of Public Works); Mr. Wm. Barber, Toronto (Superintendent of Construction); Mr. E. Brian, Windsor, Ont. (City Engineer); Mr. W P. Brereton, Winnipeg, Man. (City Engineer); Mr. Arthur E. D. Bruce, Toronto (Secretary, Northern Road Department, Provincial Government, Ontario); Mr. M. Calder, Edmonton, Alta. (Inspector of Public Works); Mr. Miles P. Cotton, Vancouver, B.C. (Contractor); Mr. W. S. Davis, Toronto (Toronto & Hamilton Highway Commission); Mr. J. W. Evans, Belleville, Ont. (City Engineer); Mr. Frank Goodman, Toronto (Jennison-Wright Company, Creosoters); Mr. Andrew W. Gray, Ottawa, Ont. (Dominion Parks Highway Engineer); Mr. W. H. Hall, Oshawa, Ont. (Corrugated Metal Culverts; Mr. Geo. S. Henry, Toronto (Secretary and Treasurer, Ontario Good Roads Association); Mr. H. C. Hocken, Toronto (Mayor); Mr. John J. Jackson, Niagara Falls, Ont. (General Superintendent, Queen Victoria Park System); Mr. E. A. James, Toronto (Consulting Engineer); Mr. Frank H. Keefer, Thorold, Ont. (President, Rocmac Company); Mr. Hugh A. Lumsden, Toronto (Public Works, Provincial Government of Ontario); Mr. F. G. Macdiarmid, Toronto (Ontario Public Works Department); Mr. H. A. Mackai, Toronto (Rocmac Roads); Mr. S. V. Martin, Bruce Mines, Ont. (President, Martin International Trap Rock Company); Mr. Geo. A. McNamee, Montreal (Secretary and Treasurer, Dominion Highway Association); Mr. W. A. McLean, Toronto (President, American Road Building Association); Mr. Frank Menzie, Niagara Falls, Ont. (President, Glutrin Road Construction Company); Mr. J. F. Mitchell, Windsor, Ont. (Superintendent, Canadian Dolorway Paving Company); Mr. Geo. Michaud, Three Rivers, Que. (Contracting Engineer); Mr. Chas. Moogk, Waterloo, Ont. (Town Engineer); Mr. Geo. Moogk, Weston, Ont. (Municipal Contractor); Mr. A. M. Rankin, Toronto (Commissioner of Public Roads and Highways); Mr. Thos. E. Riley, St. Catharines, Ont. (Contractor); Mr. J. D. Robertson, Edmonton, Alta. (Engineering of Highways); Mr. J. D. Scholfield, Toronto (representing Rocmac Roads); Mr. F. A. Senecal, Plantagenet, Ont.; Mr. H. J. Stambaugh, Jr., Walkerville, Ont. (Trussed Concrete Steel Company); Mr. S. L. Squire, Waterford, Ont. (Ontario Good Roads Association); Mr. Murray A. Stewart, Toronto (Assistant Engineer, Roadway Section); Mr. John Stocks, Edmonton, Alta. (Deputy Minister Public Works); Mr. W. F. Tallman, Winnipeg, Man. (Street Commissioner).

In the article relating to the Central Technical School, published in our issue of December 16th, mention should have been made of an important installation—the vacuum cleaning system. This equipment (known as the "Tuec") was furnished by the United Electric Company through Mr. J. J. Martindale, Toronto, distributing agent for Ontario. The installation comprises two four-sweeper TUEC stationary vacuum cleaners—making an eight-sweeper capacity installation in all. This means that the cleaning system can be used simultaneously by eight persons. An idea of the facility of operation is conveyed by the fact that throughout the building approximately 280 valves will be installed. Thus there are 280 places where the hose can be attached to the piping system. The dirt and dust are delivered through the piping system to machines in the basement from which they will be taken away periodically and burned. The air which does the work is discharged outside of the building, thus assisting in the ventilating as well as the cleaning of the rooms.

LETTERS

Editor Contract Record:

In an article on page 1385 of the Contract Record, November 11th, 1914, it is claimed that the first successful effort to stop the flow of water through fissures was carried out on the Catskill Aqueduct. The writer used this method in 1909 to seal the wall of water-tight cellars for the White Hall Building, New York City. The head of water was slightly under thirty feet, but the principle is the same. Some of the concrete forming the peripheral wall, it having been placed under adverse conditions, developed several serious leaks. Indeed, while there was no single leak of large dimensions, a 6-inch centrifugal pump was required to keep the cellar dry, and the owners doubted the ability of the contractor to overcome the trouble.

The writer suggested, and had performed under his directions, the injection of grout until the work was accepted by the owners. The surface of the concrete where defective, was cut out to a depth of about 5 inches, three-inch plank was set into this place, strongly braced and calked. A two and one-half inch pipe was placed through this plank, with a flange inside and a valve on the outside. Through this the water flowed while preparations were under way. When all was ready the discharge of a Douglas grout pump was attached; and cement grout was pumped in under pressure. No sand was used, as it was essential that no cavity, however small, should remain unfilled. A pressure upwards of 150 pounds was developed and maintained until no more could be forced in, when the valve was closed and the pump attached to another point of attack. The method proved entirely successful. The writer has used the same method several times, both previously and subsequently.

Yours truly,
E. G. Matheson.

An Important Judgment

THE Railway Commission has just given a decision on the special provision for the carriage of brick in carload lots, in which the shippers gained their point. The judgment is as follows:—

"Upon the hearing of the matters at the sittings of the Board held in Ottawa, November 26th, 1914, in the presence of counsel and representatives of the railway companies, and representatives of the complainants, the Canadian Manufacturers' Association, and the Toronto and Montreal Boards of Trade, and what was alleged, and upon the recommendation of the chief traffic officer of the board,

"It is ordered, with respect to the tariffs of railway companies subject to the jurisdiction of the Board and operating in Eastern Canada, as follows, namely:

"(a) That wherever it occurs, the provision of a minimum weight of 30,000 pounds per carload of building brick, other than enamelled or glazed brick, be supplemented to provide that should a car of the loading capacity of 40,000 pounds be ordered which the carrier is unable to furnish within a reasonable time, a car of greater capacity shall be furnished and charged for on the basis of the actual weight of the brick loaded therein, subject to a minimum of 30,000 pounds, but that should such a car so furnished be loaded in excess of 45,000 pounds, the minimum weight chargeable for freight charges shall be 40,000 pounds.

"(b) That wherever it occurs in the special tariffs applicable on brick, stone, and other commodities commonly described in the tariffs as 'building material,' the provision for an increase of 5 per cent. per foot to the tariff minimum weight in the case of cars longer than those covered thereby, be withdrawn and cancelled.

"(c) That effect be given to this order not later than December 21st, 1914."

The commissioners also decided that the C. P. R. must cancel their order putting an embargo on carloads of brick, lumber, etc., coming from C. N. R., Grand Trunk, and Intercolonial points for delivery on the C. P. R. team tracks at Mile End, Montreal. The C. P. R. alleged that it was impossible to deal with this traffic owing to congestion.

An Interesting War Talk

On the evening of Friday, December 18, the members of the Engineers' Club of Toronto were entertained to an interesting and unprecedented feature in the shape of a talk about the European war, by a French Army Officer who had fought in the thickest part of the conflict and survived serious wounds.

The speaker was Lieut. de la Haie de Silz, of the Third Chasseurs a Cheval, and the subject of his address was: "My experiences in the War from Nancy to Armentieres."

The gathering, which included a number of officers of the local militia, numbered some one hundred and fifty. Mirrorscope views of scenes and incidents in the theatre of operations enhanced the interest of the address.

The speaker was introduced to the members by Colonel Van Nostrand, President of the Club, who presided over the meeting.

Lieut. Silz opened his remarks by recounting his experiences from the date of mobilization early in August to the developments which culminated in the battle around La Bassee, in which his regiment participated. So heavy was the fighting in this engagement that Lieut. Silz and six men were the only survivors of a whole regiment.

The account of the German spying system, particularly that portion relating to the ruses employed by the enemy for the purpose of locating the presence of the Allies, was an interesting feature of the address. The speaker compared the arrogance of the German officer, and the perpetual fear of the German soldier, with the spirit of camaraderie existing between the officers and men of the French army. The speaker received an ovation upon declaring that in the western theatre of the war, the Allies' artillery was superior to the enemy's. Lieut. Silz gave a vivid description of the work of his regiment undertaken on behalf of an imperilled Belgian division. For his own personal part he was presented with a sword by the King of Belgium. The sword was exhibited and passed around the audience.

The speaker referred to the German Emperor as "His Most Ignominious Majesty," and recited his experiences of the atrocities and outrages perpetrated by the Germans.

At the conclusion of his address, Lieut. Silz was plied with many questions bearing upon matters of administration, equipment, service and regulations in the French army. He reminded those present that in France every man between the ages of eighteen and forty-eight was in uniform and under actual training.

The proceedings closed with a vote of thanks to the speaker and cheers for France and the French nation.

A Vancouver despatch states that the city recently incurred a loss of 3,000,000 gallons of water a day, one-fifth of the normal supply, owing to a break in the 18-inch water main across Burrard Inlet, caused by the dragging of an anchor of some vessel.

Mainly Constructional

East and West—From Coast to Coast

The Medicine Hat Planing Mills, Limited, have sustained a [illegible] through the destruction by fire of their [illegible] mill.

At [illegible] Falls, Ont., a by-law is to be submitted to the ratepayers in January, to authorize the construction of a sewer in the vicinity of Muddy Run Creek. The work is estimated to cost $200,000.

St. John, N.B., is the head office of a newly-incorporated firm, the Colonial Construction Company, which is capitalized at $24,000. The incorporators include Messrs. Murray W. Long and H. Colby Smith, St. John contractors.

The Hamilton Bridge Works have the contract for the steel work in connection with the Don Section of the Bloor Street Viaduct, for which the general contractors are Messrs. Quinlan & Robertson. The steel work will run into some [illegible]

At Vancouver, B.C., work will be started shortly on the interior of the new Immigration Building, which has reached the roofing stage for the Dominion Government Department of Public Works. The estimated cost of the structure of $350,000.

At Vancouver, B.C., the Burrard Inlet Tunnel & Bridge Company have awarded the contract for the construction of a steel and concrete bridge, 225-ft. centre span, to the Canadian Bridge Company, Walkerville, Ont., the contract price being $1,846,000.

The Vancouver District Joint Sewerage and Drainage Board are proceeding with the construction of a trunk sewer in Central Park, at an estimated outlay of $300,000. The general contract for the work is in the hands of Messrs. Hodgson, King & McPhalen Bros.

The annual meeting of the Canadian Car & Foundry Company, Limited, which was called for December 21 at Montreal, has been postponed until Monday, February 8. The president of the company, Hon. Nathaniel Curry, is at present in London, Eng., and his return is not expected until some time in January.

The Renfrew Machinery Company have been awarded a contract for the manufacture of a large quantity of shells for the British War Office. It is stated that the order will be sufficient to keep the factory running day and night for a period of about six months. Ordinarily the company are manufacturers of cream separators.

In the District of Algoma, Ont., about 32 square miles of timber land on Batchawaung Bay, Tilley, Archibald and Tupper townships, have been purchased by Messrs. Wells-Higman Company, St. Joseph, Mich., who are contemplating the construction of 474 ft. of docks. A shingle mill, saw mill and veneer plant will also be erected.

The Hudson's Bay Terminal and Harbor Works at Port Nelson, B.C., are progressing satisfactorily, according to a report made recently by Mr. D. W. McKughlin, Engineer-in-Charge. He has just returned to Ottawa, after an absence of nearly two years on the work, and his mission is to discuss further plans for the coming year.

An order for the manufacture of 120,000 shovels for the British War Office has been placed by Mr. Frederic Stobart, Purchasing Representative, with two Canadian firms—the Jones Shovel Company, of Gananoque, Ont., and the Hamilton Shovel Company, Hamilton, Ont. Both these firms have divided the order which is estimated to be worth more than $50,000. The shovels are to be delivered in weekly shipments.

The Westmount Council electric lighting department made a profit of $30,400 during the last fiscal year. This has been turned into the depreciation fund, now amounting to $147,000, from which amounts needed for the improvement of the system are voted. A sum of $25,000 has been drawn from this account for the extension of a new street lighting system.

At Quebec, Que., the Canadian Pacific Railway Company have at present in course of construction important additions to their freight sheds at that point, estimated to cost $200,000. The buildings will be one-storey, 30 x 368 ft., 50 x 593 ft., brick and reinforced concrete construction. Downing-Cook Construction Company, Montreal, are the general contractors.

The Montreal municipal controllers have voted $1,500 for work on the plans of a tunnel under the Lachine Canal at Wellington Street bridge. The tunnel, plans for which are being drawn by Mr. McLeod, municipal and tramways engineer, is estimated to cost $750,000. It will be at least 45 feet below the surface of the canal, and will obviate delays to traffic due to the frequent openings of the bridge to allow shipping to pass through the canal.

The city council of St. Catharines, Ont., have awarded the contract for the steel superstructure for St. Paul's street high-level bridge, to the Canadian Bridge Company, of Walkerville. The contract price, $91,000, includes the supplying of rails and track fittings, buckle plates and 300,000 lbs. of extra steel, which latter will be required in connection with the projected Hydro-Electric Railway. It is said that the tender was $20,000 below the engineer's estimate.

Notwithstanding the financial stringency which characterized the past year, the annual report submitted to the Civic Works Committee of Toronto city council by Mr. R. C. Harris, Commissioner of Works, disclosed the information that more than $10,000,000 has been expended on various public works during the last twelve months. This sum was distributed as follows:—Roadways, $3,538,002; sewers, $2,972,480; waterworks, $2,194,512; railways and bridges, $729,518; marine works, $26,265; miscellaneous, $1,445,405. During the year 89.90 miles of sewers were commenced, and 60.7 miles completed. Forty-two miles of pavements and 54 miles of sidewalks were laid, and 55 subways constructed in connection with the North Toronto grade separation. Twenty-six miles of water mains were laid, twenty-two street corners rounded, and eleven streets extended.

Reports from Ottawa would indicate that the war is not to be allowed to interfere with railway construction work in Canada. It is expected that several bills seeking new railway charters and extending the charters of lines already existing, promise to be in evidence during the approaching session. The Kettle Valley Railway will apply for permission to extend the time within which the following lines of railway, all in British Columbia, may be constructed: Summer Creek or One-Mile Creek, to Copper Mountain and Voigt Mining Camps; from Vernon to Penticton via Kelowna; from Penticton to Ozoyoos Lake; from Summer Creek to Allis or Princeton, thence to Granite Creek coal areas; from Grand Falls to a point fifty miles up the North Fork of Kettle River; from Midway to Hedley, and from Penticton to Nicola. The Western Dominion Railway Company of Calgary will apply for the usual extension of time in which to construct its authorized lines. The Brule, Grand Peace River Railway Company will seek a Dominion charter, giving it the right to construct railway, telegraph and telephone lines, commencing at a point in Alberta at Brule Lake, on the main line of the Grand Trunk Pacific and Canadian Northern Railways, northwesterly to Grand Prairie, thence northwesterly to a point in British Columbia, connecting with the terminus of the Pacific and Great Eastern Railway at or within the Peace River block; also commencing at Grand Prairie northerly to the Pacific, Peace River and Athabasca Railway at or near the point where the railway crosses the Montagneuse River, passing at or near Spirit River settlement, and crossing the Peace River at or near Dunvegan, approximately 400 miles in all.

American Concrete Institute

As already announced in these columns, the Eleventh Annual Convention of the American Concrete Institute will be held at the Auditorium Hotel, Chicago, from February 9th to 12th, 1915. This meeting will mark the completion of the tenth year of the existence of the Institute, and a specially interesting and profitable programme is being arranged.

On the opening day, Tuesday, February 9th, there will be important papers and discussions relating to the status of concrete road construction, with reference particularly to the cost of construction, and of maintenance and repairs. On the second day, Wednesday, February 10th, there will be a discussion on tests and matters bearing upon design in concrete. At least one session on Thursday, February 11th, will be devoted to concrete in art and architecture—special attention being given to the treatment of surfaces, and the more practical phases of the subject. On the Thursday evening there will be the annual banquet, which will offer attractions of varied interest.

The closing day, Friday, February 12th, will be given over to papers covering plant management and costs, the design and cost of wood and metal forms, and the method of placing, proportioning and selecting concrete materials.

Committees of the Institute will present reports on the following subjects:—Concrete Roads—Revised Specifications; Concrete Highway Bridges and Culverts—Foundations, design and construction; Concrete and Reinforced Concrete—Results of tests on 24 columns 20 ins. diameter and 12 ft. long; Nomenclature—Proposed standard notation; Insurance—Present conditions effecting the fire insurance of concrete structures; Cement Products—Recommended Practice and Specifications for Cement Drain Tile; Treatment of Concrete Surfaces—Stucco specifications on wood lath and dustless floors; Methods of Tests and Standard Specifications for Concrete Materials—Tests of aggregates and test pieces.

The Secretary of the American Concrete Intsitute is Mr. E. E. Krauss, of Philadelphia, to whom we are indebted for our information.

The following lectures have been delivered recently before the graduate students in Highway Engineering at Columbia University:—"Specifications for Sizes and Physical Properties of Broken Stone," Mr. Arthur W. Dean, Chief Engineer, Massachusetts Highway Commission, Boston (December 3); "The Essential, Physical and Chemical Properties of Creosote Oils for Wood Blocks," Mr. Sumner R. Church, Manager Research Department, Barrett Manufacturing Company, New York (December 3); "Methods of Construction of American Wood Block Pavements," Mr. A. W. Dow, Chemical and Consulting Paving Engineer, New York (December 6); "European Wood Block Pavements," Mr. George W. Tillson, Consulting Engineer to the President of the Borough of Brooklyn, New York (December 11).

Erratum.—In the article relating to the plant of Messrs. Canadian Vickers, Limited, published in our issue of December 9 last, the Herbert Morris Crane & Hoist Company, Limited, was referred to as being located in England, whereas the head office of the company is in Toronto (Mr. Malcolm Meldrum, General Manager). The firm has no branches outside of Canada.

Sewage Pumping Equipment at Chilliwack, B.C.

The City of Chilliwack, B.C., is at present constructing a complete sewerage system. As this city is situated on a level tract very little above the high-water mark of the Fraser River, it has been necessary to install a pumping plant to dispose of the sewage.

The pumping equipment includes three 3-in. Byron-Jackson vertical centrifugal pumps, bottom suction, equipped with brass open runners and brass shafting. The pumps are so designed that none of the bearings can come in contact with the sewage, and the self-oiling thrust bearings are placed inside the motor bases where they are easily accessible. With this arrangement it is unnecessary to withdraw the entire unit to raise the sump cover when it is desired to examine the bearings. On each pump is mounted a 5 h.p. type U. H. Fairbanks-Morse vertical induction motor, 220 volts, 60-cycles, 3-phase, 1,200 r.p.m., being direct connected through a flexible coupling. Each motor is equipped with two sets of radial ball bearings and a ball thrust bearing to take the weight off the rotor. Bearings are of the Shefko self-aligning type and each bearing is independently lubricated by an improved automatic oiling system whereby the flow of oil can be seen at all times. The rotors are of the indestructible type, built with cast-on-end rings.

The capacity of each unit is 200 Imperial gallons against a total head of 33 ft. The bottom part of the sewage chamber is divided into two sections. In one section the sewage collects and is led to the pumps through the dividing wall. The pumps themselves are dry and accessible at all times, but being set below the level of the sewage they are practically submerged so far as priming is concerned.

An automatic float switch is provided to each motor, and a control panel installed, by means of which any motor may be connected to any one of the three controls or disconnected from the system at will. A maximum of flexibility is thus possible. The service is a 3-wire lead covered cable run from the Power Company's transformers carried underground in conduit to the motors.

Messrs. Cleveland & Cameron, of Vancouver, are consulting engineers for the city, and the pumping equipment has been supplied and installed by the Canadian Fairbanks-Morse Company, Limited, of Vancouver.

Before the members of the Victoria and Vancouver Branches of the Canadian Society of Civil Engineers, Mr. J. S. MacLachlan, Resident Engineer of the Dominion Department of Public Works, read a paper recently on "Harbors," with special reference to harbor works at Victoria, also the breakwater and piers now under construction.

The record of improvements effected on the Dominion Atlantic Railway, which the Canadian Pacific Railway leased in 1911 for 99 years shows that new wharves have been built; [illegible] miles of new track have been ballasted; [illegible] miles of new [illegible]-pound rails have been laid down; 120 cattle guards have been filled and replaced by surface guards, while dozens of bridges have been either improved or rebuilt. In round figures [illegible] feet of wooden bridges have been replaced, or will be replaced very shortly, by steel bridges, concrete arches, and rail top culverts. New brick stations have been built. A general renovation has taken place, costing mony thousands of dollars. The new stations include those at Wolfville and Annapolis Royal, Mosherville, Patterson and Iberville. During the past two years [illegible] stations have been repaired and painted, and platforms have been erected. A new line from Centreville to Weston, [illegible] miles in extent, has been built.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Fernie, B.C.

The town council and the Canadian Northern Railway have been authorized to construct a subway on Cox Street, 7 ft. 6 in. high and 8 ft. wide. Mr. Wm. Ramsay is town engineer.

Fort William, Ont.

The ratepayers of th.s city will vote on a by-law shortly, to authorize the raising of $18,000 for the purpose of paving a [illegible] completed by the Canadian Pacific Railway recently. Mr. Ray R. Knight is the engineer.

The ratepayers of this city will vote on a by-law at next municipal elections to authorize the expenditure of $65,000 on waterworks extensions. Mr. Ray R. Knight is city engineer.

Huntingdon, Que.

Tenders will be received by Mr. R. S. Feeny, secretary-treasurer, Municipal Council, until January 2, for macadamizing with sand stone finish various roads in this Municipality.

Hull, Qne.

The city council is contemplating the expenditure of $200,000 upon the installation of an 8,000,000-gallon turbine pump and extensions to water mains, in this city. Mr. J. A. Laforest is city engineer.

Hamilton, Ont.

Work has been started by day labor upon the construction of a storm overflow sewer system, at an estimated outlay of $300,000. The city engineer is Mr. A. F. MacCallum.

Montreal, Que.

The general contract to erect a pumping station here, at an estimated cost of $5,500, has been awarded by the city council to Mr. T. F. Dwyer, 414 Merchants Bank Building. The contract for roofing will be sub-let by the general contractor.

Ottawa, Ont.

The city council has started work by day labor on surface drainage in connection with the laying of asphalt pavement between Preston Street and Viaduct, at an estimated cost of $8,000. Mr. F. C. Askwith is city engineer.

Surface drainage work has been commenced by day labor in connection with $20,000 pavement scheme on O'Connor Street. Tenders are now open for balance of work.

Parkhill, Ont.

The ratepayers of Parkhill will vote on January 4th on a by-law submitted by the town council to authorize the expenditure of $3,000 for extension to water-works. Mr. John N. Groves is the town clerk.

Port Hope, Ont.

Plans are being prepared by Messrs. Smith & Smith, Colborne Street, Lindsay, engineers-in-charge, for laying 4,000 ft. of sewers, of which 3,000 ft. will be a trunk sewer, to serve the westerly section of this city south of Rideau Street. Mr. R. Gray is secretary of the town council.

Toronto, Ont.

The Board of Control has decided not to open bids for Section 2, high level interceptor, and cast and steel pipe for same, until January 19th.

Watford, Ont.

The ratepayers of this village will consider a by-law on January 4, seeking to authorize the construction of a vitrified tile drain in the northern part of the village, at an estimated outlay of $5,000. Mr. B. B. Dann is the clerk.

Winnipeg, Man.

Tenders will be received by Mr. S. H. Reynolds, Commissioner, Greater Winnipeg Water District, 901 Boyd Building, for all labor, material, etc., required in the excavation of a channel between Indian Bay and Snowshoe Bay (arm of Shoal Lake).

Waterloo, Ont.

The town council is starting work shortly upon the construction of three miles of macadamizing, 16 ft. wide, estimated to cost $27,000. The work will be done by day labor. Mr. J. A. Perras is Asst. Secretary-Treasurer.

CONTRACTS AWARDED

Montreal, Que.

The contract for erecting a bridge 20 x 200 ft. across Vinet Street has been awarded by the Thos. Davidson Manufacturing Company, 187 Delisle Street, to the Dominion Bridge Company, Lachine, Que., at $2,000.

Strathclair, Man.

The Municipality of Strathclair has let the contract for the construction of two bridges over Wolfe Creek to Mr. Duncan Buchanan, Basswood, Man., at $577. The bridges are to be completed by March 1st.

Toronto, Ont.

The Board of Control has awarded the following contracts for sewer construction:—McLaren & Company — Merrill $416, Stacey $483; Mr. F. Angotti—Stanton, $2,400; Routly & Summers—Sproatt $1,080; Provincial Contracting Company —Roseheath $1,145, Bastedo $1,563; Orpen Company, Limited—Rosepark $1,635; Connolly Agnew Company — Keswick Drainage System $8,000; J. McGuire—Concord Avenue $885; McKnight Construction Company—Earlham $696; Commissioner of Works—Delaware Avenue $650, Glendu $535, Sawden $195, Ridge $4,350.

Railroads, Bridges and Wharves

Guelph, Ont.

The Guelph Radial Railway Company have been authorized to construct an extension to their Street Railway system, consisting of a single-track line on Suffolk Street. Mr. A. H. Goshi is the Superintendent and General Manager.

Hamilton, Ont.

Bridge plans have been approved by the Hamilton Bridge Company for high level bridge which will probably be erected under the supervision of Toronto-Hamilton Highway Commission, at Carroll's Point, at an estimated cost of $327,000. It was erroneously stated in our issue of December 9 that concrete plans were to be submitted by the Canada Cement Company.

Kaslo, B.C.

The location of a new station to be erected at Kaslo has received the approval of the Railway Board of Commissioners. The owners of the station will be the Canadian Pacific Railway.

Lindsay, Ont.

The Grand Trunk Railway Company have been authorized to construct a siding into the premises of Horne Bros., Woollen Mills.

Montreal, Que.

The Canadian Northern Railway has been authorized to construct a railway siding into the premises of Thos. Davidson Manufacturing Company, Limited.

Mitchell, Ont.

The chairman of the building committee, Mr. W. R. Cole, will purchase interior fittings for new school building, two-storey, 102 x 70, eight rooms, brick construction, for the School Board.

Norwich, Ont.

The Railway Board of Commissioners has approved of the location for a new G. T. R. station at Norwich; also for the construction of tracks across Main St.

Province of Alberta.

The Canadian Northern Railway has been authorized by the Railway Board of Commissioners to construct a spur to serve Glocum Howland Coal Properties on Sec. 9, Twp. 29.

Stratford, Ont.

The Board of Railway Commissioners has authorized the Grand Trunk Railway to construct a siding to serve the Stratford Chair Company, Limited.

Baggage room and office belonging to the Grand Trunk Railway Company at this city have been damaged by fire to the extent of $3,500.

Toronto, Ont.

The board of control has referred the following tenders for the Rosedale Section of Bloor Street Viaduct, to Mr. R. C. Harris, Commissioner of Works, for examination and report:—(1) $312,458.03; (2) $351,512.31; (3) $371, 019.18; (4) $417,947.49; (5) $384,663.77; (6) $476,587.92; (7) $310,515.74.

Waterloo, Que.
The C. P. R. have been authorized by the Railway Board to construct an extension to existing siding at mileage 3092, to serve Wallace & Robinson Co.

Public Buildings, Churches and Schools

Athabasca, Alta.
This School District has decided to erect and equip a school building here. Mr. M. W. Hitchins, Athabasca, is treasurer.

Arran, Sask.
The Arran School District, No. 3480, has in contemplation the erection of a school building. Mr. W. J. McKeen is the senior trustee.

Briercrest, Sask.
The Briercrest School District, No. 3479, will erect a school building here. The senior trustee is Mr. M. MacPherson.

Brunetta, Alta.
Brunetta School District 3032 has been authorized to obtain a loan to build and equip a school here. Mr. C. H. Gage, Brunetta, is treasurer.

Elrose, Sask.
The Elrose School District, No. 3478, has decided to erect a school building here. Mr. R. A. McKellar is senior trustee.

Glenbogie, Sask.
The Winding Creek School District will erect a school building at an early date. The senior trustee is Mr. Irving Trainor.

Grandes Bergeronnes, Que.
The parish of St. Zoedes have in contemplation the construction of a church estimated to cost $25,000. Rev. Amedee Gaudreault is the curate. The architect has not yet been appointed.

Hardisty, Alta.
Opal School District 3024 (Mr. W. Scott, Hardisty, trustee), are taking steps to obtain the necessary funds for the construction of a school building here.

Leo, Alta.
Coyote Flat School District, 2901, has been authorized to raise $1,500 for erecting and equipping school building here. Mr. C. H. Starling, Leo, is treasurer.

Landonville, Alta.
The erection of a school building is contemplated by the Northern Star School District 3092. Mr. C. V. Larson, Landonville, is treasurer.

Lonira, Alta.
Lonira School District 3057 (Mr. Geo. Turner, Lonira, treasurer), has been authorized to procure funds for erecting and equipping a school building.

Meanook, Alta.
The Provincial Government has authorized this School District to raise $1,500 for erecting and furnishing a school building. Mr. [illegible], Meanook, is treasurer.

Montreal, Que.
A permit has been issued to the St. Philomene Parish, Rosemount, for the alteration of a church on Fifth and Sixth Avenues. Estimated cost $5,000.

Ogden, Alta.
Maryland School District has decided to borrow $4,200 to erect and equip a school building. Mr. J. J. Martin, Ogden, is treasurer.

Province of Saskatchewan.
The Clarkson School District (Mr. N. A. Nicholson, trustee), has been empowered to borrow money to erect and furnish school house, sink well and fence grounds.

The Buena Vista School District has in contemplation the erecting and furnishing of a school building and the purchase of a site. Mr. O. Halverson Lenian is treasurer.

Rastad, Sask.
The Oadas School District 3477 has decided to erect a school building. Mr. Philip Weisbeck, Rastad, is senior trustee.

Stettin, Alta.
The School District of Stettin has been authorized to borrow funds for building and equipment of school. Mr. Noble Hammond, Stettin, is treasurer.

Vancouver, B.C.
Designs have been submitted for Vancouver Civic Centre, consisting of a City Hall, Public Hall and Auditorium, Public Library, Technical College, two museums, and an art gallery. First prize of $500 has been awarded to Mr. Thos. Korner and Mr. H. M. Matocks, Vancouver; second prize of $250 to Mr. F. L. Townley, 325 Homer St., Vancouver.

Business Buildings and Industrial Plants

Caledonia, Ont.
A business block, owned by Mr. Wm. Leith, grocer, Mr. J. Martindale, stovemaker, and others, has been destroyed by fire. Loss to buildings $16,000; insurance $12,000.

Hamilton, Ont.
Drying-plant, engine house, clay sheds, and store room, which were damaged by fire recently are being repaired by the owner, Mr. W. H. Cooper, 67 York St., at an estimated outlay of $12,000.

Kincardine, Ont.
The town council will submit a by-law to the ratepayers to borrow $15,000 for the erection of a knitting and woollen mill—$5,000 for construction of building and $10,000 for equipment. Those interested in the project include Mr. Wm. Mitchell, Mayor, Mr. John Scougall, Secretary, Board of Trade, and Mr. G. Morrison, Postmaster.

Longue Pointe, Que.
The Canadian Northern & Quebec Railway, St. James Street, Montreal, have obtained a permit to erect an engine [illegible] 120 x 80 ft., at an estimated cost of $4,500.

Lindsay, Ont.
The Woollen Mills belonging to Messrs. Horne Bros., William Street, have been totally destroyed by fire.

MacLeod, Alta.
The MacLeod Flour Mills have been damaged by fire with a loss to building and contents of [illegible]. The property was partly insured.

Ottawa, Ont.
All work will be done and all material purchased by Mr. A. Carpentier, 141 Main Street (general contractor) in connection with alterations to stores on Rideau Street for LeDroit Printing Company.

Plans are drawn for the construction of two stores and apartments on Bank St., at an estimated cost of $25,000. The buildings will be brick construction, concrete foundation, shingle roofing. Mr. W. G. Davis, 5 Spruce Street, is the architect.

Revelstoke, B. C.
The ratepayers have defeated a by-law which was submitted to them recently, for the purpose of authorizing the raising of $10,500 for the purchase of a site upon which to construct a market building. Mr. R. A. Gordon is city clerk.

St. Roch L'Achigan, Que.
The St. Roch L'Achigan Canning Company, care of the General Canning Company, 65 St. James Street, Montreal, P. O. Box 1743, will erect a canning factory building next year, at an estimated cost of $3,000. The company are at present receiving prices on canning machinery, glass canning goods and steam engine and boiler, at an estimated cost of $2,500.

St. Thomas, Ont.
A loss estimated at $10,000, is reported to have been caused to the Costumier's Parlors belonging to Mr. D. G. Davidson. The loss is covered by insurance.

Welland, Ont.
A quantity of building material will be purchased by Ryan & Gardiner, general contractors, for restaurant, etc., for the Empire Cotton Mills Company, Queen Street East. Building will be one-storey, 50 x 100, brick construction, estimated to cost $4,000.

Wiarton, Ont.
Hardware store, the property of Mr. Jas. Flett, has been destroyed by fire here. Loss is estimated at $10,000.

Residences

London, Ont.
Tenders will be called by the architect, Mr. W. G. Murray, Dominion Savings Building, in the second week in January, for contract to construct a two-storey, 24 x 35 ft. red brick residence for Dr. R. Ferguson, 141 Wortley Road, at a cost of $3,500.

A quantity of lumber, pressed brick and interior trim will be purchased by Messrs. Copp Bros., 83 Byron Avenue (owners), in connection with the construction of twenty residences on [illegible] Avenue, pressed brick construction. Estimated cost $3,800 each. Of these residences eleven have been completed, three are almost completed and the others will be started this spring.

Montreal, Que.
A permit to carry out alterations to a flat, one-storey, [illegible], has been issued to Mrs. G. Belair, 148 Marquette Street.

A permit to erect two flats on Lasalle Avenue has been issued to Mr. Percy F. [illegible].

Niagara Falls, Ont.
Plans have been prepared by the architect, Mr. J. W. Collins, 49 Benson Street, for two-storey brick residence, [illegible], which will be erected for Mr. John Daw-

[illegible] care of Dawson Bros., Queen Street, Estimated cost $3,500. No contracts have yet been let.

Tenders for heating, plumbing and electrical work on two-storey residence for Mr. Alvin Smith, Southend P.O., will be called shortly by the owner.

In connection with two-storey residence on White Avenue for Zimmerman Brothers, 23 McRae Street, heating, plumbing and electrical contracts will be let.

Ottawa, Ont.

Prices on plastering, painting, heating, plumbing and electrical work will be invited shortly by Mr. Dan Mariatz, 5 Hull Street, in connection with a $4,000 brick veneer residence.

Prices on plastering, painting, heating, plumbing and electrical work are at present being received by Mr. W. R. Clark, 130 Sherbrook Street, owner and general contractor, in connection with the construction of a residence on Sherbrook, at a cost of $4,500.

Prices on plastering, painting, heating, plumbing and electrical work will be invited shortly by the owner and general contractor, Mr. A. Davidson, 69 Grosvenor Street, for $4,600 residence, two-storey, double brick veneer construction, 34 x 36.

Tenders for plastering, painting, heating and electrical work in connection with $4,800 residence, 2½-storey, 25 x 36, brick veneer construction, will be called shortly by the owner and general contractor, Mr. James Allan, 175 Broad St.

Work is being done by day labor on $5,000 residence, two-storey, 36 x 40, double brick veneer construction, which is in course of construction for Mr. J. Poleman, 250 Bell Street. Mr. J. T. Blythe, Ottawa, has the contract for heating and plumbing.

Tenders will be called shortly for plastering, heating, painting, plumbing and electrical work in connection with $5,500 residence for Mr. M. A. Robinson, 73 Glen Avenue. Building will be 2½-storey, 36 x 36, double brick veneer construction.

Tenders on plastering, painting, heating and electrical work are invited by Mr. A. Levern, 285 Preston Street, who is erecting a $4,500 brick veneer residence.

Prices are at present being taken on plastering, heating, painting, plumbing and electrical work in connection with brick veneer residence estimated to cost $4,500, in course of construction for the owner, Mr. W. C. Leach, 140 Spadina Avenue.

The erection of a $4,500 residence, brick veneer construction, is contemplated by Mr. H. Ellis, 112 Bell Avenue.

The construction of a brick veneer residence, estimated to cost $5,000, is contemplated by Mr. A. E. Toms, 36 Main Street.

Toronto, Ont.

Materials will be purchased and some of the smaller trades sub-let in the spring by Messrs. J. Redwood & Son, 9 Howard Park Avenue (owners), in connection with the erection of one pair of two and one-half storey residences on Garden Avenue, at an estimated cost of $10,000.

Plans are drawn for one pair of residences, two-storey, 28 x 40, concrete and brick construction, at an estimated cost of $5,000, for Mr. H. P. Pegler, 82 Frizzel Avenue.

Verdun, Que.

A permit to erect a $2,500 flat on Verdun Avenue, has been taken out by Mr. D. Boyer, 1648 Notre Dame Street. Mr. A. Fornier, 216A Joseph Street, has the general contract.

Permits to erect one flat each have been issued to Messrs. P. Crockford, 60 Hickson Avenue, and W. E. Beechy, 246 Rielle Avenue.

Power Plants, Electricity and Telephones

Berlin, Ont.

The Kaufman Rubber Company, Limited, will purchase a 250 or 500 volt d.c. motor, or a generator of 150 to 300 h.p. A 250-volt motor is preferred.

Miscellaneous

Edmonton, Alta.

The ratepayers of this city have defeated a by-law which was submitted to authorize the expenditure of $50,000 on extensions to gas system at Viking, Alta.

Halifax, N.S.

The Board of Control has made a recommendation that $11,500 be included in next year's estimates, to provide a chemical fire engine for the city. The proposition will be considered by the city council at next meeting. Mr. P. J. Broderick is Chief of the Fire Department.

Ottawa, Ont.

The city council will invite tenders shortly for the supplying of 600 tons of asphalt and a quantity of brick for 1915. Mr. F. C. Askwith is the city engineer.

Toronto, Ont.

The Board of Control has received twenty-three bids for the construction of a park shelter in Withrow Park, at an estimated cost of $12,000. The tenders have been referred to the City Architect and the Park Commissioner for report.

Tenders for one or more 20,000,000-gal. pumps have been opened by the Board of Control, and referred to Mr. R. C. Harris, Commissioner of Works, for report.

Mr. V. H. Peardon, architect, 229 College Street, Toronto, is desirous of replacing his stock of catalogues, price lists, etc., covering building materials of all kinds.

Winnipeg, Man.

Tenders will be received by Mr. S. H. Reynolds, Chairman of Greater Winnipeg Water District, 901 Boyd Building, until January 18, to supply the following machinery: 1 crusher, 1 rotary screen, 3 belt elevators, 3 belt conveyors, 1 power boiler, stack, pump and engine, complete excavating machinery, 4 locomotives, 46 dump cars, 20 flat cars, 10 box cars, 1 passenger and 1 baggage car, 4 cabooses, 1 deep well pump. Specifications can be seen at office of Greater Winnipeg Water District.

New Companies

E. R. Tait Shingle Company, Limited, has been incorporated with a capital of $50,000 to acquire as a going concern the business carried on at Vancouver, B.C., under the firm name of E. R. Tait Shingle Company; also to carry on business throughout the Dominion as lumber and timber merchants, saw mill and shingle mill proprietors, woodenware manufacturers, etc. The headquarters of the company is at Vancouver.

Canadian Roofing Manufacturing Company, Limited, has been incorporated with a capital stock of $100,000 to manufacture and deal in roofing material and shingles, wall-board, etc. The head office is at Windsor, Ont. The incorporators include John Hancock Brown, manufacturer; Alexander Robert Bartlet and Walter G. Bartlet, all of Windsor.

The Star Boiler & Radiator Company, Limited, has been incorporated to manufacture and deal in iron, copper, steel and all their products, also to manufacture heating furnaces, radiators and other apparatus. The capital stock of the company is $200,000 and the incorporators include Ulrick Granger, merchant, and Edward Michaud, accountant, both of Montreal, where the head office of the firm is situated.

Chambly Manufacturers Limited, has been incorporated with head office at Montreal and a capital stock of $200,000, to manufacture and deal in machines, machinery supplies, etc., also to construct electric plants, motor works, tramways, bridges, etc. The provisional directors include Alexander P. Mathieu, Hall A. Beaudry and Armand Mathieu, all of Montreal.

Ridley Kennedy, Limited, has been incorporated with head office at New Westminster, B.C., to manufacture and deal in motor vehicles, including automobile trucks, motor trucks, etc. The capital of the company is $10,000.

The Taylor Engineering Company, Limited, has been incorporated with a capital of $50,000 for the manufacture of machinery, machine tools and electrical appliances; also to carry on the business of mechanical, electrical and civil engineers. The headquarters of the Company is at Vancouver, B.C.

The firm of Gardiner & Gaskill, engineers, Montreal, have dissolved.

Port Lobos Petroleum Company, Limited, with head office at Montreal, and a capital stock of $30,000, has been incorporated to engage in the production, manufacture and sale throughout the world of petroleum, gas, etc. The incorporators include: Chas. G. Ogden, barrister and King's counsel; H. C. G. Mariotti, barrister, and Jos. A. Perodeau, all of Montreal.

Societe de Construction des Maisons Ouvieres, Limitee, has been incorporated to carry on business as contractors and builders generally and to manufacture ceramic tile, cement, lime, asphalt and other building materials. The new firm has a capital stock of $50,000 and the headquarters of the company will be at Montreal. The incorporators include Jules Antoine Marcel Marin and Charles Desmarais, accountants, both of Montreal.

Trade Inquiries

The following enquiries relating to Canadian trade have been received. The names of the firms making these enquiries, with their addresses, can only be obtained by those specially interested in the respective commodities, upon application to the Enquiry Branch, Department of Trade and Commerce, Ottawa. Reference number is to be quoted when requesting addresses.

No. 1227. **Wire Nails.** A Birmingham firm is in a position to represent a manufacturer of wire nails. Can command large sales at present time.

No. 1229. **Building Specialties.** A manufacturers' agent in Manchester wishes to represent Canadian manufacturers of building specialties, either on commission or otherwise.

No. 1234. **Machinery.** A North of England firm who are manufacturers of machinery for making tin canister work, such as food tins, paint and varnish tins, and petrol tins; also general tin-plate machinery, power presses, etc., are desirous of doing business in Canada.

No. 1238. **Barb Wire, Fencing and Wire Nails.** A Bristol firm wants barb wire, wire fencing and wire nails.

No. 1239. **Wire Nails.** A Bristol firm desires to represent a Canadian firm exporting wire nails.

No. 1240. **Asphalte.** A Bristol firm wishes to get into touch with Canadian importers of asphalte.

No. 1242. **Nickel and Nickel Chrome.** A firm in Paris with an established trade, desires to obtain quotations from producers of nickel and nickel-chrome, for which a good demand exists at present.

No. 1244. **Tin.** A wholesale hardware house in Marseilles invites quotations from producers or exporters of tin.

No. 1247. **Machinery, Electrical Goods, Implements, Tools and Hardware.** Agent and Engineer returning to London, Eng., is open to represent manufacturers of machinery, electrical goods, implements, tools and hardware.

Cement Top Floors

The Aberthaw Construction Company, Boston, specify as follows for cement top floors. This specification is for laying hard finish on new rough concrete whether filling, piling or slabs supported by form.

Finish to be mixed one part of cement to two parts crushed trap rock or hard gravel screening, which will pass through a half inch [illegible] dust has been removed. This is to be thoroughly mixed in a mixing box or by a machine mixer, with an amount of water to produce a plastic but not a sloppy [illegible] crete before either the finish or the under-concrete has had time to set, floated with a wooden float to a true level and [illegible] as soon as possible to bring it to proper level and to smooth the top slightly. The [illegible] not be dead smooth or slick like a sand finish.

After the finish has been troweled and [illegible] will not mar the surface, it should be covered with sawdust, sand, cloths, or any other material which will hold water on it continuously. In building re- [illegible] ing about the work filling the forms, and generally getting in the way. In work- [illegible] there is usually plenty of old felts which [illegible] venting this.

[illegible] for at least a week, or, better, for ten days. After two days it is possible to put up studs and do miscellaneous work on top of the new finish, provided it is not allowed to dry out.

Laying Cork Tile Flooring

For many uses a cork tile over a concrete structural floor offers qualities which can be developed by no other material.

In applying cork tile flooring to concrete we use two methods, according to conditions. On new work, in which we furnish the under floor or can dictate its composition, we lay on the concrete floor slab while still green 1 in. of asbestos concrete composed of 1 part Portland cement, 1 part asbestos fibre and 3 parts sand. This is troweled to a true surface with a sidewalk finish, ½ in. below the finished floor level. This composition makes a fibrous bed which will hold a nail.

When this is thoroughly dry, the cork tile are applied, being first bedded in a special waterproof mastic. They are laid by a method which closes and cements all joints, at the same time distributing the pressure evenly over the surface. The tile are bradded into place with headless brads which are driven below the surface of the tile and hold them in place while the mastic is setting up, which requires about twelve hours. On hard concrete or any other surface into which nails cannot be driven, the tile are weighted into place. The result is the same in both cases, but in the latter more time is required, and it is somewhat more expensive in consequence.—Concrete-Cement Age.

Face Brick and Flue Linings

Face brick is an item of growing importance. In the earlier days face brick simply meant the selecting of good hard brick from among the kiln run of common brick. Today the term "face brick" has a distinct meaning to many people and is a separate brick from the type known as a common brick. There has been enough interest and development in this matter that there was organized some time ago a face brick manufacturers' association composed of clay workers who manufacture fine brick especially for wall facings. Meantime the interest in face brick color schemes and architectural effects has led to a great line of face brick products with characteristic trade names. These include hundreds of shades in brick running from white enamel through gray and buff to reds, then to very dark colors, almost black. They include soft finishes, mat and rug faces, oriental effects and rustic orders.

Face brick of this kind naturally sells at a higher price and goes into building [illegible] money to get artistic beauty and satisfy [illegible]

Fire brick and flue linings constitute an item of special interest in the fall and winter. The practice of using fire clay linings for flues and chimneys is becoming almost universal now. In most cities [illegible] lining brick and stone chimneys, but at times chimneys and flues are built of con- [illegible] linings.

[illegible] backs and sides of fireplaces and grate openings.

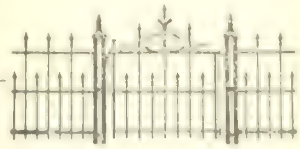
Waterproofing Concrete

Many articles are appearing in the technical journals, written in the interest of special paints and coatings for concrete surfaces, in which it is stated that cement waterproofing, in powder or liquid form, decreases the strength of the cement or affects the metal used for reinforcement. These statements, as applied to the standard brands of waterproofing, are far from the facts in the case. Millions of pounds of waterproofing powder are used yearly by the leading engineers and cement-workers of the country, and the makers of standard waterproofing material have great numbers of tests, by reliable authorities, which show not the slightest injurious effect on strength.

As to the claim that a material like good waterproofing, which is absolutely neutral, insoluble, inert and unchanged with age, could attack the metal reinforcement is too absurd to be discussed. There is no doubt that the many attacks on cement waterproofing by parties interested in promoting other materials have done must to deter inexperienced users from adopting waterproofing material of recognized value, but trained engineers pay little attention to loose statements unsupported by proof, and base their judgment on reliable records of long-time tests.—Building Age.

Another example of a home upon the roof of a towering office building is found in the Bungalow apartment which has been fitted up on the roof of the 20-storey skyscraper recently completed at 18 East Forty-first Street, New York City. It consists of a suite of five rooms, styled a "Bungalow Apartment," and with it goes a miniature garden. This outfit has been leased for the owner to Donald Brian, a well-known actor. Many of the modern skyscrapers have pent houses on their roofs, some serving as living quarters for the superintendent and his family; others are used for a variety of purposes, but so far as known the above is the first case of where the rooms on the roof have been rented out. The idea, however, suggests a way of utilizing roof space.

Two carloads of American made concrete mixers, valued at $10,000, are being shipped to Australia, having been ordered from the Milwaukee Concrete Mixer Company by A. W. O'Mara, general manager of the Australian Metal Company. Mr. O'Mara, who recently arrived in Mil- [illegible] than 100,000 men have gone to the front, business in Australia in most instances is good.



IRON Fences, Wire Fences, Gates, Fire Escapes, Jail Cells, Office Wirework, Wire Baskets and all kinds of Builders' Wire and Iron work.

THE PAGE WIRE FENCE CO.
LIMITED
Walkerville Toronto Montreal St. John

Tenders and For Sale Department

Greater Winnipeg Water District

Tenders for Equipment

[illegible] the undersigned [illegible] Monday, January 18th, 1915, for the supply of gravel pit Excavation, Screening, Elevating and Crushing Machinery. Also for Locomotives and Cars for pit and for railway service.

Specifications and form of tender may be obtained and form of contract may be inspected at the offices of the District.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners.

Winnipeg, Man.,
[illegible]
[illegible] 14th, 1914 51-52

AGENTS WANTED

Large firm making a complete line of concrete machinery and gasoline engines, trucks and barrows, wants sales agents for Ontario and Quebec. Now successfully represented in the West. Box 121, Contract Record, Toronto, Ont. 51-2

AGENTS WANTED

One of the largest firms on the Continent making motor trucks, wants sales agents for whole or part of Canada. Putting out a truck which represents one of the most important advances in truck manufacture. It drives from all four wheels and likewise steers and brakes on all four wheels. Company very strong financially. Box 120, Contract Record, Toronto, Ont. 51-1

AGENTS WANTED

Large United States firm manufacturing steel wheels, farm trucks, handy wagons, logging and traction wagons, dump carts, engine carts, etc., wants Provincial agents throughout Canada. Write stating what territory you can cover. Box 119, Contract Record, Toronto, Ont. 51-1

AGENTS WANTED

If you are absolutely responsible and are interested in selling a successful, high-grade line of Concrete and Mortar Mixers manufactured by a firm long established, let us know at once. We are now making new contracts for 1915 and need a few reliable dealers and agents in unoccupied territories. References required from parties not rated. Address, Box 118, Contract Record & Engineering Review, Toronto, Ont. 51-3

Late News Items

Barrie, Ont.

The Masonic Lodge here have in contemplation the carrying out of alterations to hotel on Owen Street, which was purchased recently. Work will commence next spring. Mr. Alfred Wilkes, Editor, "Barrie Gazette," is chairman of committee. Estimated cost $5,000.

Carleton Place, Ont.

General store owned by J. B. Jardine & Sons has been damaged by fire to the extent of $1,000 to building and $2,000 to stock. Loss was partly insured.

Fredericton, N.B.

Tenders will be received by Mr. R. C. Desrochers, Ottawa, Secretary, Dominion Government Department of Public Works, until January 12th, for interior fittings in Post Office, including oak and wire screen cornice, wickets, shelving, counters, desks, plate glass, marble desks and dado. Plans and specification are at offices of Mr. A. C. Fleming, Clerk of Works, Fredericton; Mr. D. H. Waterby, Clerk of Works, St. John, and at Department, Ottawa. Estimated cost $133,000.

Fenelon Falls, Ont.

The rebuilding of stores and warehouses destroyed by fire recently is contemplated by the owners, Messrs. W. T. Robson (implement warehouse), J. Foster (harness store), F. C. Chambers (carriage works), and F. C. Taylor (hardware and tinsmith).

Hamilton, Ont.

Canadian Quarries, Limited, Stoney Creek Road, have been awarded the contract to supply crushed stone to the Board of Control.

The contract for Interior Fittings will be let shortly in connection with $60,000 School Building on Wentworth Street for the Board of Education. Building is 2-storey, 12-roomed, brick construction. Mr. P. H. Foster is the Secretary.

Lindsay, Ont.

The building of a new Factory, three-storey, fireproof and brick construction, and the installing of new machinery, etc., for Woollen Mills, is contemplated by Messrs. Horne Bros., William Street. Work will be resumed in temporary premises, as Power House was not destroyed in recent fire. Mr. Alex. Horne is the Manager.

Mr. T. Bakegeorge, care Olympia Candy Works, Kent Street, contemplates erecting a garage, ironclad construction.

The Town Council has decided to purchase 1 load of 6-in. tile sewer pipe and connections. Mr. A. J. Williams is the engineer.

London, Ont.

Grand Stand at Fair Grounds of the Western Fair Association was burned down recently, involving a loss of $8,000. A new stand will be built. Mr. A. M. Hunt, 21 Edward Street, is the Secretary.

Niagara Falls, Ont.

Glasgow's Shoe Store, and Mr. R. W. Booth's Stationery premises were damaged by fire recently. Loss on building $1,000, stock, etc., $5,000. Property was insured.

Ottawa, Ont.

The City Council will invite tenders shortly for C.I. castings for grates, service posts, etc., for 1915. Mr. F. C. Askwith is City Engineer.

The following losses have been sustained through fire in stores, etc., on Sparks and Bank Streets, owned by the Sherwood Estate, and occupied as follows:—Ketchum & Company, sporting goods, loss $60,000; Sherwood, furnishings, loss $10,000; Cadillac Hotel, Prop., Robt. Kennedy, loss $5,000; Capital Auto Specialty Company, loss $3,000.

The residence of Mr. J. Burnett, 377 Lisgar Street, has been destroyed by fire, incurring a loss of $3,500, which was insured.

Stores and apartments owned by T. D. McFarlane & Son, Casting Shop, 115 Bank Street, have been destroyed by fire. Loss $6,000.

South Edmonton, Alta.

Interior fittings and furnishings will be purchased in the near future by the Senator, University of Alberta, in connection with new $450,000 University Buildings now in course of construction. Mr. Burgess, University of Alberta, is the architect; George C. Fuller Company, Limited, Winnipeg, are the general contractors.

Welland, Ont.

Mr. James Asher, Welland, P. O., has decided to rebuild farm buildings, including barns, etc., recently destroyed by fire. Work is to be started in the spring. Estimated cost $5,000.

Winnipeg, Man.

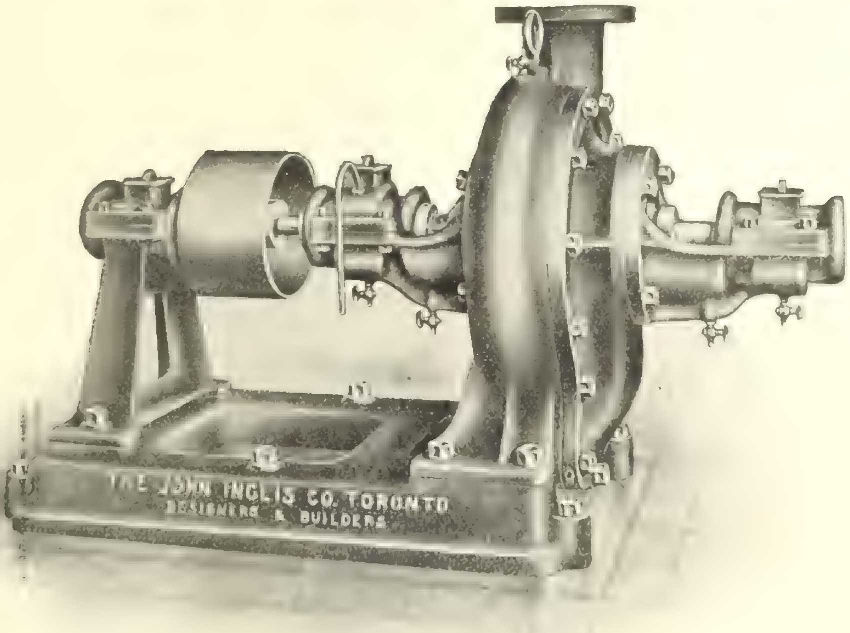
The following additional contracts for laying sewers, estimated to cost $13,290, have been let by the Board of Control:—Mr. C. Meyer—Wellington Crescent, $623.50; Medland Street, $619.60; Quebec Street, $1,913.25. J. W. Astley, Engineer of Construction—Weston Street, $10,133.20.

Tenders will be received by the Board of Control until January 2nd for supply and delivery of 3,600 ft. of No. 0000 B and 53 core, 2500 volt, lead covered paper insulated cable. Specification is with Mr. J. J. Glassco, 54 King Street, Manager, Light and Power Department.

Openings in macadam pavements are a source of annoyance and offer a difficult problem because it is impractical to use a roller in repairing them, on account of the expense. The superintendent of streets of Chicago, Walter G. Leininger, reports that his department has obtained splendid results with the use of asphaltic and other bituminous binders, which enables them to secure, without the use of a roller, a repair better than the original pavement.

In building the Conduit dam on the White Salmon River in Washington, 10 per cent. by weight of the cement of the 1:3:5 mixture was replaced by hydrated lime. Before the lime was adopted laboratory experiments were made on briquettes to ascertain whether the strength was in any way decreased. These tests showed that such briquettes compared favorably both wth briquettes made of lime and sand and those made of cement and sand. The concrete mixture used on the job was "fat, greasy and plastic" and flowed smoothly through comparatively flat chutes without separation of the mixture. The cost of the hydrated lime was slightly in excess of that of the cement replaced, but it is stated that this extra cost was made up for by the greater ease in placing.

PUMPS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DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

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ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—Delivered in 5 barrel lots, $1.85 per bbl.; with bags $2.25; car lots, $1.55 on the track, with bags $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $17 f.o.b. the job; No. 2, $14; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $8.50 on the cars, delivered $9.50; "Tapestry" brick, $20 to $30; sand-lime brick, $7.50; King Edward Siding; $6.50 at the mill; $8.50 delivered on the job. Paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2 $14; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex face brick, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

Concrete brick—Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27. Other quotations on application.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45

STEEL AND IRON

Steel—(round and square bars) $2.25 base; twisted and deformed, $2.50; structural sections $2.75 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $8.75 to $9 per 100 lbs.

Boiled linseed oil—in bbls., 59c per gal. of 9 lbs.

Raw linseed oil—in bbls., 56c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 68c per Imp. gal. south ern gauge.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal (C. P. R. terminals).

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up. $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4.10 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.85 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 14c basis per pound; British manilla, 11c basis; African hemp, 11c; sisal rope 9½c basis. Boiled linseed oil—in barrels, 59c per gal. of 9 lbs. Raw linseed oil—in barrels, 56c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.20.

Lime—Grey, 34 cents per bushel; white, 32 cents. Kelly Island lime $2.10 per 200 lbs.

Brick—No. 1 dry pressed, red and buff, $35; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; ¾-in., $2.90; stone dust, $2.50; rubble stone car load lots, delivered, $13 per cord. Del-South of Assinboine $1 extra.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Crushed Granite—1½ and 2-in., $2.65; ¾-in. and 1-in., $2.90; ¾-in. and dust, $3.20.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.40 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $38 per ton.

(Continued on page 62)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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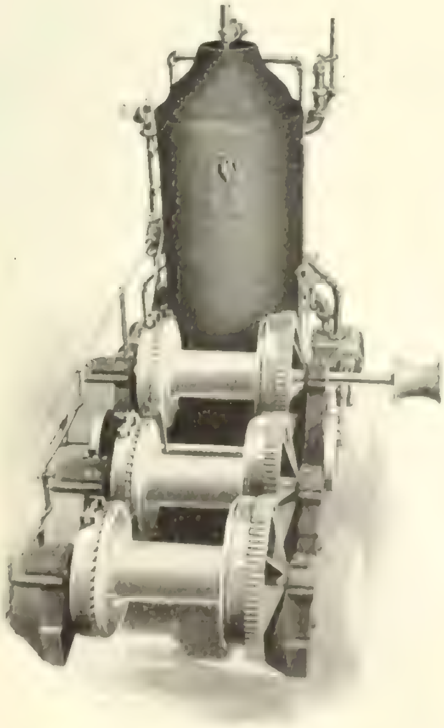

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Hoisting — Material Handling — Excavating Equipment

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Hoisting Engines—Clamshell Buckets—Steel Derricks
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We are in fine shape this Winter to take care of your repair work. Our large stock of patterns, our years of experience, our engineering and manufacturing facilities enable us to handle repair jobs on Dredges and other equipment at minimum cost to you.

Careful attention given all inquiries on repairs and special equipment

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E. LEONARD & SONS, St. John, N.B.
A. R. WILLIAMS MACHINERY CO., Winnipeg

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

([illegible] page 60)

SEWER PIPE

Sewer Pipe—[illegible] prices [illegible] Winnipeg per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., [illegible] cents, 8 in., 30 cents, 10 in., 40 cents; 12 in., 50 cents; 18 in., [illegible]

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, [illegible] per ton, Hammer Brand, $3.75 per bbl

PAINTS AND OILS

Paints and Oils.—White lead, ground in oil, $9.40 per 100 lbs.; boiled linseed oil, in bbls., 69 cents per gal.; raw linseed oil, in bbls.; 66 cents per gal.; dry red lead, $8.50 per 100 lbs.; putty in bulk, $3 per bbl.; putty in 25 lb. tins, $3.35; turpentine, in bbls., 75 cents [illegible]

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; [illegible], sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $11 f.o.b. warehouse, $10.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings; fire brick, $35; fire clay, $12 per ton.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr.)—all sizes up to 12 x 12, $10 to $12; up to 14 x 14, $11 to $13; sizes from 16 x 16 to 20, 8 x 20, $13 to $15 squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $23; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 13c. per ft.; 6-in. 25c. ft.; 8-in., 30c. ft.; 10-in., 40c. ft.; 12-in., 50c. ft.; 15-in., $1.05 ft.; 18-in., $1.25 ft.; 20-in., $1.50 ft.; 24-in., $2.25 (all net prices).

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$11.50 to $12.00 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 82c. per gal. of 9 lbs.

Raw linseed oil—in bbls., 80c. per gal.; red lead, dry, $8.50 to $10.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 90c.

Block Stone, Dimensions, Random, Head Sills, Shoddy, Stone Sawing

Sackville Freestone Co., Limited, Sackville, N. B.

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Goold, Shapley & Muir Co.
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Towers and Tanks for all purposes.

Concrete Mixers

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Water supply outfits of every description.

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"Metallic" Building Materials

Build up Canada—Now is the time!

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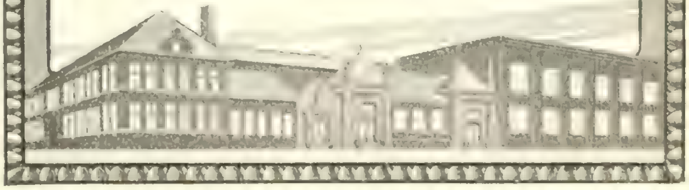
You can get as good, or better values right here at home. This is no exaggeration. Let us place our catalogues of the famous "Metallic" line — CANADIAN OR BRITISH - MADE THROUGH AND THROUGH—[illegible] we can easily prove our claims.

The "Metallic" line includes "Empire" Corrugated Iron; "Eastlake" Steel Shingles; Steel Siding, Ceiling and Wall Plates; "Hayes" Patent Lath; Skylights; Ventilators; Galvanized or Copper Cornices; Fireproof Doors and Windows; Well Curbing; Culverts; Conductor Pipe and Eave-troughs.

N. B. No "Keystone" or other foreign-made sheets used.

Metallic Roofing Co., Ltd.

Manufacturers—Toronto & Winnipeg



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COATED AND WRAPPED

Made in sizes from 2" to 10" inside diameter with different thicknesses for varying pressures.

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Three Rivers, Quebec
Wayagamack Pulp and Paper Co., Ltd.
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Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

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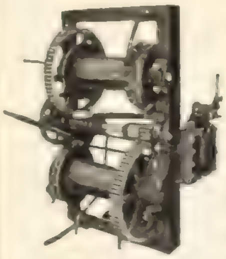
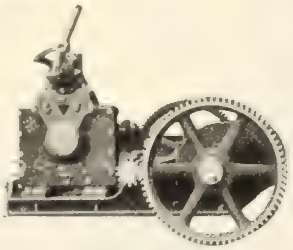


Motor Crab

Write for catalog and prices

Dake Engine Co.
Grand Haven, Mich.



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"Queenston Blue" Limestone

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Crushed and Rubble Stone

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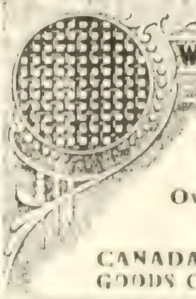

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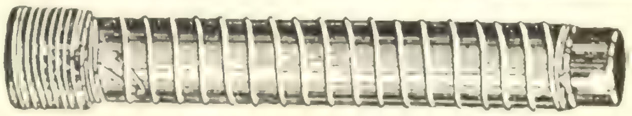

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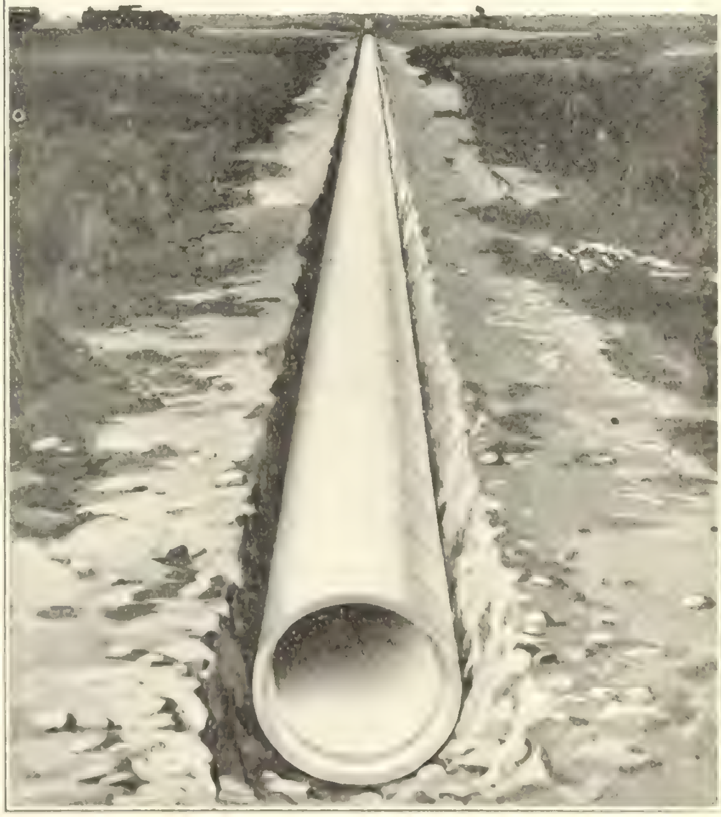

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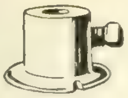
Fig. 1

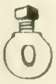
Fig. 2

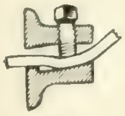
Fig. 3

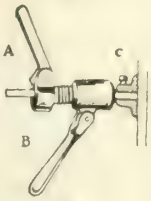

Fig. 4

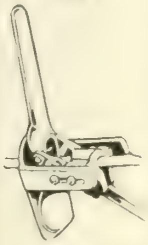
Fig. 5

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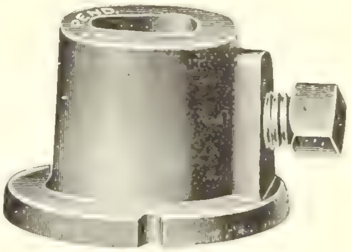

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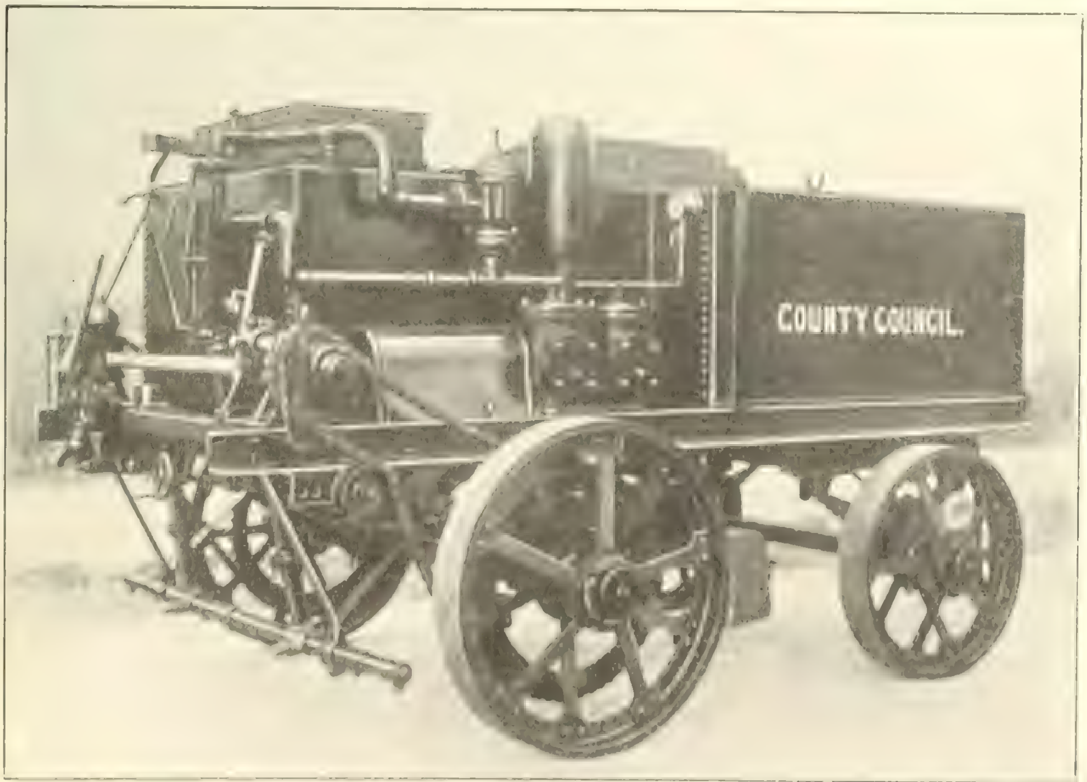

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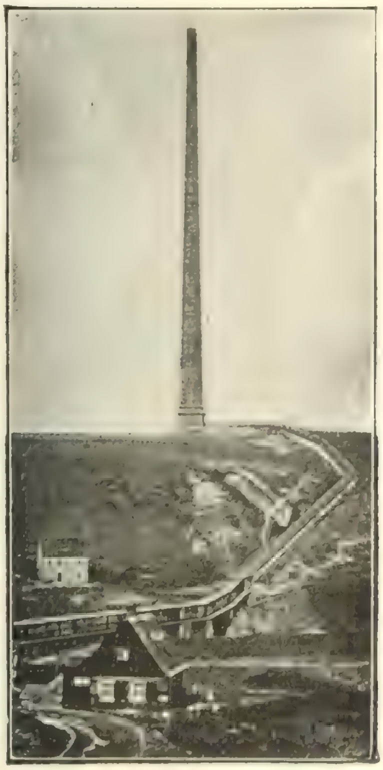
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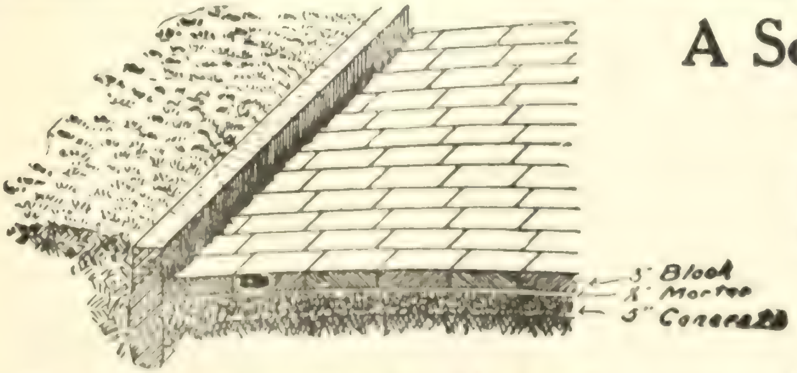

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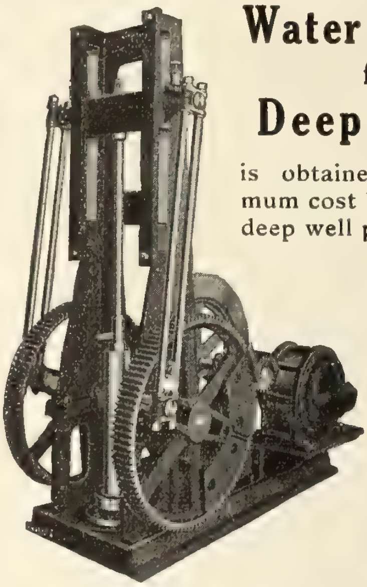

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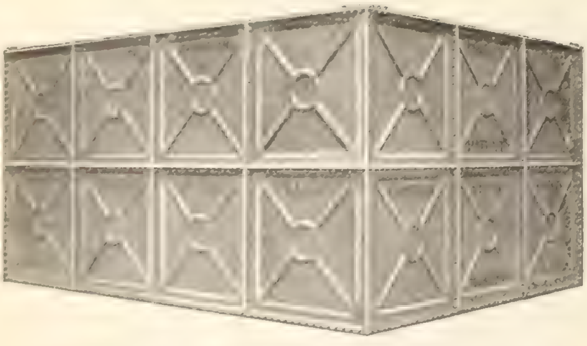

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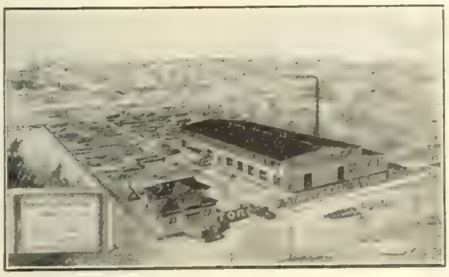

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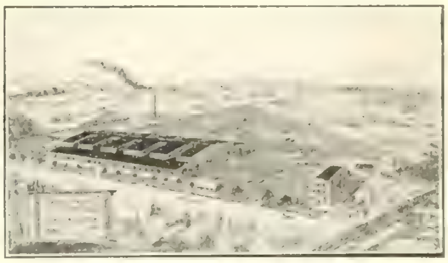

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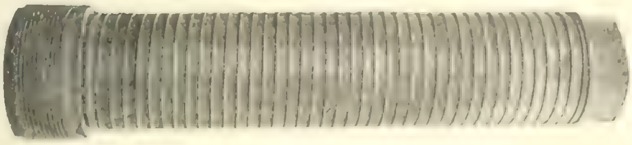

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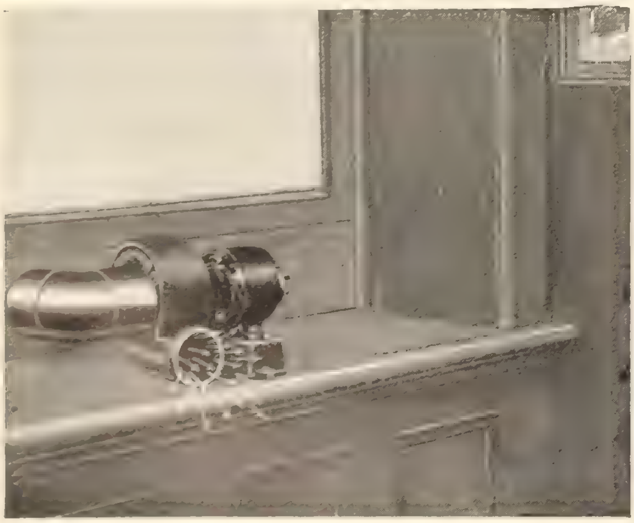

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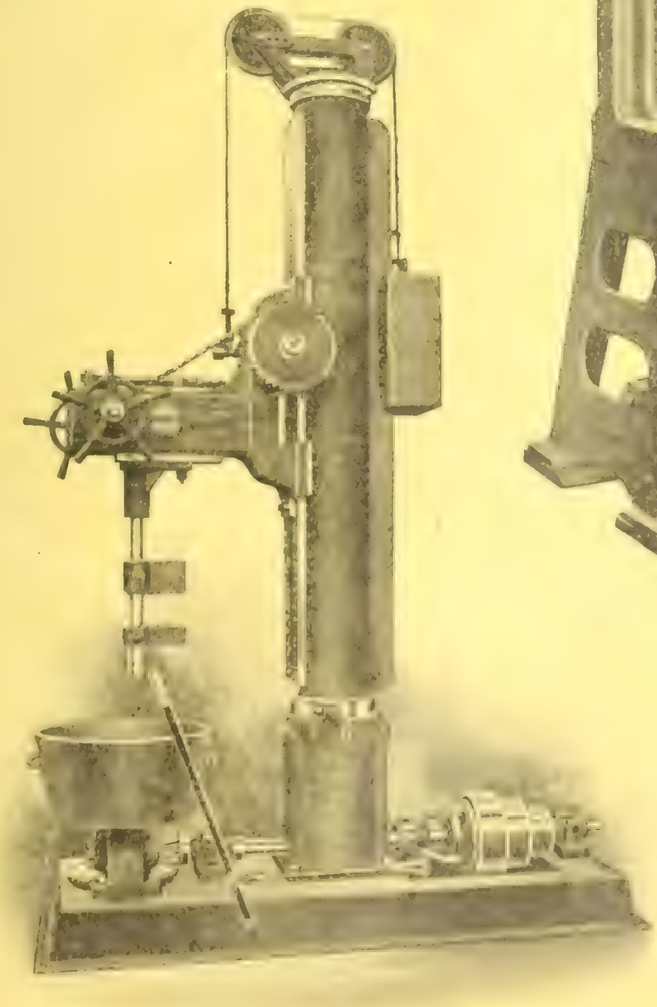

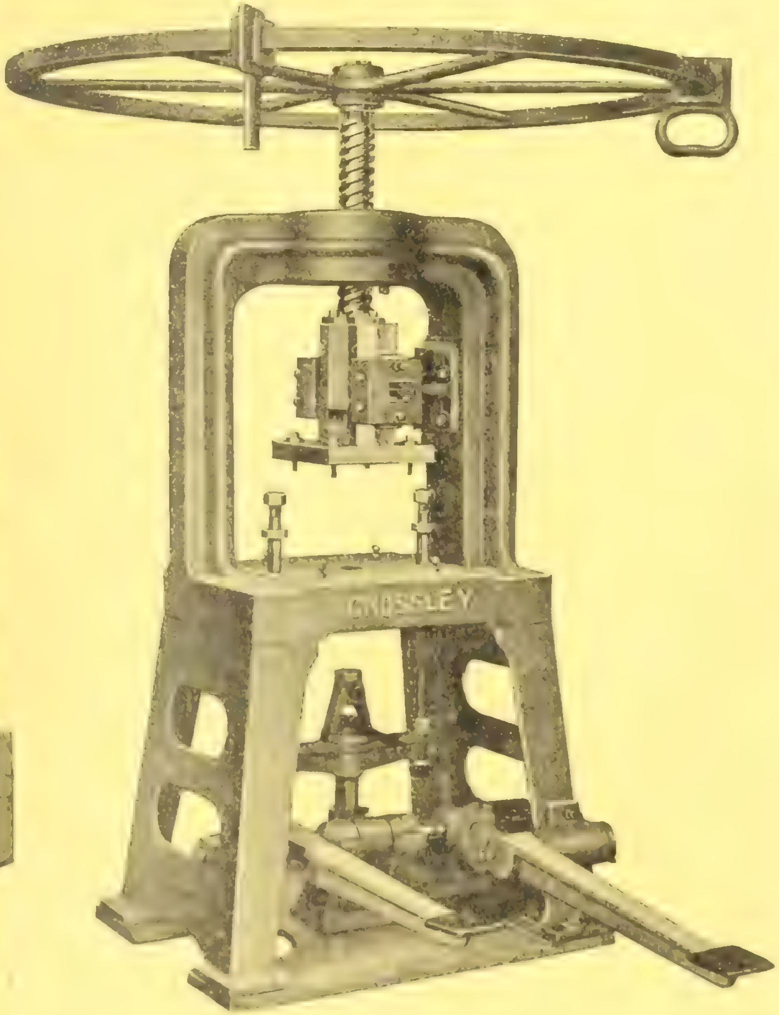

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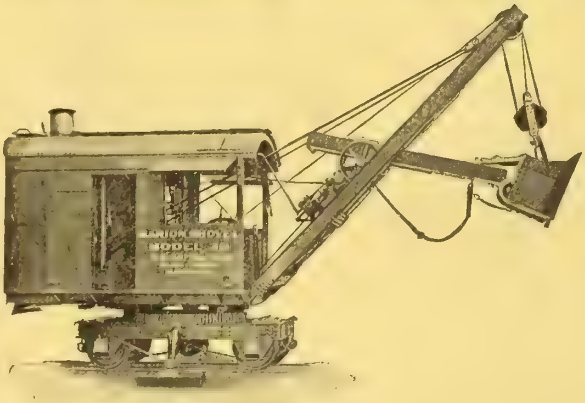

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